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**Stratigraphy of the Naples Group
(Late Devonian)
in Western New York**

By
ROBERT G. SUTTON
Temporary Geologist
New York State Museum and Science Service



**NEW YORK STATE MUSEUM
AND SCIENCE SERVICE
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The University of the State of New York
The State Education Department

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CONTENTS

	PAGE
Abstract	5
Introduction	6
Acknowledgments	7
Distribution of the Naples group.....	7
Stratigraphic nomenclature	7
Stratigraphy	10
Formations underlying the Naples group.....	10
Formations overlying the Naples group.....	11
Naples group	11
Middlesex black shale.....	12
Cashaqua formation	13
Sawmill Creek member.....	14
Rock Stream member.....	17
Rye Point member.....	17
Rhinstreet black shale.....	18
Hatch formation	19
Conclusions	21
Lithology	21
Black shale	21
Gray shales	24
Siltstones	26
Carbonates	33
Fauna	35
Environments	40
Siltstone facies and environment.....	41
Sedimentary structures and textures.....	41
Fauna	43
Conclusions	43
Black shale facies and environment.....	43
Sedimentary structures and textures.....	43
Fauna	44
Conclusions	44
Gray shale facies and environment.....	45
Sedimentary structures and textures.....	45
Fauna	46
Conclusions	46
Relationship of the environments.....	47
References	48
Appendix	51
Keuka Lake (east) composite section.....	51
Sawmill Creek section.....	54

ILLUSTRATIONS

	PAGE
Figure 1. Distribution of Naples group and location of described sections	Inside back cover
Figure 2. Facies relationship of formations in the Naples group	Inside back cover
Figure 3. Genundewa-Cashagua exposure 2 miles northeast of Sturgeon Point, Lake Erie.....	15
Figure 4. Sandstone beds about 3 feet thick in the Rock Stream member, Wagener Glen, Keuka Lake.....	16
Figure 5. Naples group. Sections between Lake Erie and Seneca Lake	Inside back cover
Figure 6. Photomicrograph of Rhinestreet black shale (X8), Whetstone Creek, 2 miles west of Honeoye, N. Y.	22
Figure 7. Same as figure 6 (X75).....	22
Figure 8. Cashagua shale (X75), Hemlock Lake, N. Y.	25
Figure 9. Cashagua shale (X75), at Friend, N. Y.	25
Figure 10. Casts of lobate flow markings.....	31
Figure 11. Siltstone with distorted laminae.....	31
Figure 12. Nonlaminated siltstone (X8) Rock Stream member, Cashagua formation, Bristol Center section.....	32
Figure 13. Same as figure 12 (X75).....	32
Figure 14. Parrish limestone (X8) in Cashagua formation.....	34
Figure 15. Relation of faunas.....	37
Table 1. Geographic distribution and lithologic relationships of the fauna	28

Stratigraphy of the Naples Group (Late Devonian) in Western New York

BY
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Temporary Museum Expert

ABSTRACT

The Upper Devonian Naples group in New York State is composed of four formations: Middlesex black shale (bottom), Cashaqua formation, Rhinestreet black shale, and Hatch formation (top). The Cashaqua formation is subdivided into three members: Sawmill Creek (new), Rock Stream, and Rye Point (new). These are recognized from Conesus Lake to Seneca Lake. The four formations may be traced from Lake Erie eastward to Seneca Lake where they intertongue with the Ithaca and Enfield Formations of the Cayuga Lake region.

There is much evidence to support the conclusion that black muds (Middlesex and Rhinestreet) were deposited in the west during the advance of the silty facies from the east. Gray muds with a restricted pelecypod and ammonoid fauna were present in the west during the retreat of the silty facies. Variations in depth and circulation of the water appear to be the principal factors governing the amount of organic matter in the muds.

Fine-grained, even-bedded siltstones and shales pass eastward into crossbedded siltstones and fine-grained sandstones. The thin siltstone beds of the Hatch formation and the Rock Stream member were deposited by turbidity currents.

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INTRODUCTION

The Naples group is a westward thinning wedge of clastics of Late Devonian age in western New York State (figure 1). Four formations are recognized. They are: Middlesex black shale (bottom), Cashaqua formation, Rhinestreet black shale, and Hatch formation (top). Directly below the Naples group is the Genesee group, described by Grossman (1944). The Grimes sandstone overlies the Naples group and passes westward into the Angola shales (figure 2).

This study was initiated in the summer of 1950 and continued in parts of the field seasons of 1952 and 1953, supported by grants from the New York State Museum and Science Service. Preliminary progress reports were submitted in 1952 and 1953. This is a final report on the investigations of the Naples group from Lake Erie to Seneca Lake.

The author has attempted to correlate the lithology and fauna of several measured stratigraphic sections. Thicknesses of formations and members as well as changes in lithology were recorded. Interpretations of the depositional environment were made where possible. Thin section studies supplemented field observations.

Hall (1840, 1843 and 1879) and Clarke (1885, 1898 and 1904) described the lithology and fauna of the Naples group. They devoted more attention to the fossils than to the strata. Chadwick (1935) likewise emphasized the faunal succession as a means of subdividing the Upper Devonian of New York.

This paper emphasizes the lithology rather than the fossils. Stratigraphic sections, chosen for their completeness, were measured by means of a Jacobs staff and Brunton compass. Descriptions of the rocks are based upon field observations, supplemented by microscopic examination of hand specimens and thin sections. Fossils were collected and identified wherever possible. No attempt is made to redescribe or redefine the genera or species collected. Existing paleontological literature was deemed adequate for the purposes of this study. The contributions of Clarke (1898, 1904) were particularly helpful.

Seventeen stratigraphic sections were chosen at intervals of 10 miles or less. A lack of good exposures increased this distance in some places. Where exact correlations were in doubt, less well-exposed sections were examined and described. Rapid facies changes also required more closely spaced sections.

ACKNOWLEDGMENTS

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DISTRIBUTION OF THE NAPLES GROUP

The Naples group extends from Lake Erie to Seneca Lake. Equivalent strata occur in eastern New York, where, according to Chadwick (1935, pp. 313-314), they form the "main mass of the Catskill Mountains." Sections were measured between Lake Erie and Seneca Lake, a distance of 120 miles. The strata dip less than one degree to the south or south-east and are overlain by successively younger formations in those directions. A monocline in the Batavia quadrangle (Chadwick, 1932, p. 143) and gentle folds between some of the Finger Lakes (Bradley and Pepper, 1938, p. 29) have been reported.

The Naples group is exposed in high cliffs along the southern edge of Lake Erie (figure 1, section 1). It is exposed farther east in high cliffs along valleys cut by northwestward flowing streams (figure 1, sections 2 and 3). East of Cayuga Creek, exposures occur in small branches of the north-south valleys (sections 4-8). East of the Genesee River, numerous lakes occupy the north-south valleys. Good exposures occur in small streams that discharge into these lakes (sections 9-17). An excellent section may be found in the Genesee River gorge between Mount Morris and Letchworth Park (section 7).

STRATIGRAPHIC NOMENCLATURE

A brief review of stratigraphic terminology is presented for two reasons. First, many different meanings have been associated with the term "Naples" and other terms have been applied to the rocks of the Naples group. Second, a clear understanding of the changes in terminology is necessary in order to make use of the literature on the paleontology of the Naples group. A review of the terms "Portage" and "Chemung" may be found in Wilmarth (1938) and Schuchert (1943).

Hall (1840, p. 390 ff.) first described the Upper Devonian section in western New York. He found that the "Upper Black Shale" of the Ithaca region was overlain by what he called the "Cashaqua shale and sandstone." The name "Gardeau or Lower Fucoïdal Group" was given to a "thick mass of shales and flagstones" above the Cashaqua. The Gardeau was overlain by the "Portage or Upper Fucoïdal Group." Hall's "Upper Black Shale" included what is now called the Genesee black shale, West River shale, and Middlesex black shale.

Vanuxem (1842, pp. 170-174), in his survey of the Third Geological District, referred to the "Portage or Nunda Group." This group included the Cashaqua shale, Gardeau and Portage Groups, and Sherburne flagstone and shale. Hall accepted this revision and in his work on the Fourth Geological District (1843, p. 224 ff.) used the terms Cashaqua shale, Gardeau shale and flagstones, and Portage sandstones. Hall's original definition of the Cashaqua is still used today.

The term "Portage" was used for many years. Williams (1884) and others referred to the "Portage fauna," meaning the cephalopod and pelecypod fauna in the Upper Devonian of western New York. Williams also noted the difference between the fauna in the supposed Portage at Ithaca and that of the "Portage" farther west. He placed the Ithaca "Portage" in quotation marks.

Clarke (1885, p. 36) applied the term "Naples" to the strata of Ontario County because of his inability to distinguish the subdivisions of the Portage previously defined by Hall. Clarke's order of succession was: (1) soft olive-green and grayish shales with some thin flagstones; (2) black, bituminous shales-Lower Black Band; (3) greenish, drab, soft shale with some calcareous concretions and flagstones; (4) black shales-Upper Black Band; (5) flagstones. Clarke did not intend the term "Naples" to supercede the term "Portage" in western New York. He clearly states (p. 35):

The term Naples Beds or Naples Shales, by which I have here proposed to designate the Cashaqua and Gardeau series is used advisedly and in accordance with the precedent of adapting local names for formations . . .

By 1894, Clarke (p. 750) recognized the Hamilton, Genesee, Naples, Portage sandstone, and Chemung in the Naples region.

Meanwhile Williams (1887, p. 812) continued his studies of the faunal relationships westward from Ithaca into the Genesee Valley and beyond, showing that the Ithaca fauna was a separate and earlier stage of the Chemung fauna and that the Portage fauna was probably partially pelagic and restricted in geographical distribution and stratigraphic range. He pictured the latter making an appearance where the conditions were "unfavorable for the more vigorous brachiopod faunas." Clarke

(1897, p. 52) accepted this faunal relationship as shown by Williams, but proposed that the western or Portage fauna be named the Naples fauna and the eastern one be called the Otselic fauna because the Ithaca assemblage contained elements of both faunas in its standard section. Both would exist during the Portage epoch.

A different interpretation was placed upon the Naples-Portage relationship by Merrill (1898, p. 137). He divided the Portage into the (1) Cashaqua shale, (2) Gardeau shale and sandstone, (3) Naples beds, and (4) Portage sandstone.

In his first report on the Naples fauna, Clarke (1898, p. 32) still refers to the Portage group, but notes that the fauna does not coincide with the strata. The Naples fauna extended above the Portage sandstones into the beds he called the Wiscoy shales. In 1903 Clarke (p. 23) referred to the lower and upper black bands as Middlesex and Rhinestreet, respectively. Luther (1902, p. 627) traced the Grimes sandstone from the Naples region west into the middle of Hall's Gardeau. Thus the collapse of the original section presented by Hall was complete. The black shales of the basal portion were now the Rhinestreet black shale, the rocks above the Grimes sandstone were called "Gardeau" (restricted from earlier usage) and that portion between the Rhinestreet and Grimes was named Hatch by Luther (1903, p. 1005). In the Naples region, Clarke and Luther (1904, p. 6) limited the "Portage beds" to the Middlesex, Cashaqua, Rhinestreet and Hatch, because Ithaca fossils were found in the overlying Grimes sandstone.

Chadwick (1935, pp. 313-314) presented a faunal differentiation of the Upper Devonian. The validity of his revised stratigraphic groups was demonstrated by a quantitative analysis of the number of species confined to a given group compared with the number that are not. The stratigraphy was revised at this time and new names added (1935a, pp. 857-862). In both papers, "Naples Group" is used and subdivided into: (1) Middlesex black shale, (2) Cashaqua shale, (3) Rhinestreet black shale, and (4) Hatch flags and shale. The Genesee group below consisted of (1) the Genesee black shale, (2) Genundewa limestone, (3) West River shale, and (4) Standish flags. Above the Naples, the name Chemung group was applied, consisting of (1) Grimes, (2) Gardeau, (3) Letchworth, (4) Portage and (5) Wiscoy, in the Genesee valley.

Bradley and Pepper (1938, pp. 1-68) proved the persistence of many of the formations mentioned above. Key horizons were traced across the area. The base of the Grimes, the base of the Rhinestreet, the Parrish limestone lentil (upper Cashaqua), the top and the base of the Middlesex are some of the horizons found to be reliable. The upper portion of

the Cashaqua, named the Rock Stream flagstone member, was found to be increasingly silty toward the east.

Cooper, et al. (1942, pp. 1729-1794), used essentially the same names and correlations as Chadwick. The name Chemung group was omitted, and no group name was applied to the formations just above the Naples group.

The author follows the classification of Cooper, et al., with two exceptions. First, the term Attica shale is abandoned, and the Rhinestreet black shale is recognized as far west as Lake Erie. Second, members of the Cashaqua formation are proposed in the area between Conesus Lake and Seneca Lake.

STRATIGRAPHY

FORMATIONS UNDERLYING THE NAPLES GROUP

The Genesee group underlies the Naples group. Grossman (1944) divided the group into the Genesee black shale (below) and the West River shale (above). East of Keuka Lake the West River was subdivided into the Penn Yan tongue (below) and the Milo tongue (above) by a westward extension of the Sherburne siltstones, locally called the Starkey tongue. The West River is predominantly dark gray shales interbedded with thin limestones, black shales and septaria. The West River-Middlesex contact is sharp in some sections and less definite in others. Grossman (1944, p. 46) placed the contact at the "first continuous sequence of black, fissile shale," the procedure followed here. The West River may be confused with the Cashaqua formation. The dark gray shale, large septaria and numerous specimens of a large form of *Pterochaenia fragilis* distinguish it from the Cashaqua in the field.

Thin beds of the Genundewa limestone occur between the Genesee black shale and the West River shale (Cooper, et al., 1942, chart 4). Grossman (1944, p. 45) abandoned the name "Genundewa." He believed the beds were a "discontinuous shell limestone facies of the West River."

The lithology and fauna of the Genesee group are very similar to those of the Naples. The Genesee black shale is persistent as are the Middlesex and Rhinestreet black shales. The Sherburne siltstones and its westward tongue (Starkey) have the same stratigraphic relationship to the West River as does the Rock Stream member to the Cashaqua formation. Their faunas contain mainly pelecypods and ammonoids. Many species are common to both.

FORMATIONS OVERLYING THE NAPLES GROUP

The Naples group is overlain by the Grimes sandstone from Warsaw, N. Y., to Seneca Lake. West of the Genesee River, the Grimes is a thin-bedded siltstone. Eastward, the beds become thicker and coarser grained. Fragments of fossils belonging to an Ithaca or Chemung fauna may be found in many localities, but their preservation is generally poor. Crinoids and brachiopods have been noted. East of Keuka Lake, sandstones similar to those of the Grimes appear in the Hatch formation.

Above the Grimes sandstone are the Gardeau flags and shales. They overlie the Hatch formation west of Warsaw in the absence of the Grimes sandstone. The Grimes and Gardeau are equivalent to the Angola shale, in part (figure 2), which overlies the Rhinestreet black shales because of the disappearance of the Hatch formation west of Attica, N. Y.

NAPLES GROUP

The Naples group consists of four formations: (1) Middlesex black shale, (2) Cashaqua formation, (3) Rhinestreet black shale, and (4) Hatch formation. The name Attica shale, formerly applied to the Naples strata above the Cashaqua formation in the Lake Erie region, is here abandoned, and the term Rhinestreet black shale is applied westward to Lake Erie (figure 2).

Black shales predominate in the western sections; only 30 percent of the sections are gray shale. Eastward the gray shales and siltstones increase in abundance whereas the black shale decreases in thickness. Siltstones and arenaceous shales are characteristic of the Seneca Lake sections. Fossils are most common in the gray shales. Pelecypods and ammonoids predominate. Faunal zones have been established, which aid in correlating sections that display rapid facies changes.

The base of the Rhinestreet black shale may represent a time line. Two thin beds of black shale occur in the Cashaqua formation and may also represent time lines. No conclusions have been reached concerning the relative ages of the Naples group across western New York. If the base of the Rhinestreet black shale is a time line or close to it, the Rhinestreet-Hatch contact is probably older in the east. The Hatch sediments were deposited in the east and gradually expanded westward. A similar relationship may exist between the Middlesex black shale and Cashaqua formation (figure 2).

The Naples group increases in thickness from west to east, as indicated by the following measurements (figure 5) :

	SECTION	THICKNESS IN FEET
(West)	Lake Erie	169
	Cazenovia Creek	212
	Wyoming*	331
	Mt. Morris-Letchworth Park	492
	Conesus Lake	500
	Honeoye Lake	511
	Middlesex	628
(East)	Keuka Lake	858

* Incomplete section with Middlesex covered, but shale is estimated to be 12 feet thick from exposures a few miles away.

East of Conesus Lake, the Cashaqua is composed of three members. They are (from the base upward) : the Sawmill Creek (new), the Rock Stream, and the Rye Point (new). The Parrish limestone lentil is found near the upper contact of the Cashaqua formation. This lentil may be traced from the Bristol Valley to Seneca Lake. It will be described in greater detail under the discussion of the Rye Point member.

Descriptions of the lithologic units of the Naples group follow.

MIDDLESEX BLACK SHALE

Clarke (1903, p. 23) gave the name "Middlesex black shale" to the basal part of the Naples beds at Middlesex, in Yates County, N. Y. Upper and lower contacts have been drawn where the gray shales first appear. These contacts are not always sharp, and in some sections the choice was an arbitrary one.

The following thicknesses were obtained:

SECTION	THICKNESS IN FEET
Lake Erie Composite	4
Cazenovia Creek	7
Tannery Creek	13
Beards Creek	26
Mt. Morris-Letchworth Park	30
Conesus Lake	22
Hartson Point	42
Honeoye Lake	46
Middlesex	47
Keuka Lake (east)	69
Rock Stream	43
Sawmill Creek	6

The above measurements show an eastward thickening to a maximum near Keuka Lake, then a thinning to Seneca Lake. Recently the Middlesex has been identified in the Cayuga Lake sections.

From Lake Erie to Wyoming the Middlesex consists of homogeneous black shale. Eastward, however, thin beds of gray shale occur in the center of the formation. At Honeoye, thin siltstones occur within the gray-shale units, and the latter thicken considerably. Some black shales

in the Sawmill Creek member of the overlying Cashagua formation are believed to be eastward tongues of the Middlesex.

The black shales are sparsely fossiliferous for the most part, although they were not examined for a microfauna. Only *Lingula* sp., *Styliolina fissurella* and *Protosalvinia huronensis* were found.

CASHAGUA FORMATION

The name Cashagua was given to the shales overlying the Middlesex by Hall (1840, p. 390 ff.). The type locality was designated as the exposures along Cashagua Creek (now Keshequa Creek), one-half mile south of Sonyea, N. Y. This formation is well defined by the black shales of the Middlesex below and the Rhinestreet above. It thickens from the shore of Lake Erie to Seneca Lake. The following tabulation shows this eastward increase in thickness.

	SECTION	THICKNESS IN FEET
(West)	Lake Erie Composite	28
	Cazenovia Creek	53
	Wyoming	92
	Beards Creek	127
	Mt. Morris-Letchworth Park	166
	Keshequa Creek	116
	Conesus Lake	142
	Honeoye Lake	177
	Bristol Center	234
	Middlesex	280
	Keuka Lake (west)	225
(East)	Keuka Lake (east)	367
	Sawmill Creek	480

In western sections, the Cashagua is composed of soft, bluish-gray shale, which rapidly weathers to an olive brown. This shale is interbedded with thin limestones, many of which are fossiliferous. Numerous septaria and concretions occur here. Limestones are absent in the basal Sawmill Creek member to the east, although concretions persist to the Genesee valley.

A few thin siltstone beds occur at the base of the Cashagua formation near Conesus Lake (figure 5). Farther east siltstones form a larger proportion of the formation and occur at a higher stratigraphic position. They make up the upper two-fifths of the Cashagua in the Keuka Lake and Seneca Lake valleys. Gray and black shales below them are herein designated the Sawmill Creek member. The shales above are named the Rye Point member. The siltstones between were previously named the Rock Stream member (figures 2 and 5).

In the past, the Cashagua formation has been designated as a shale, or shale and sandstone. Its complex and varied lithology, as evidenced by the lithologic changes just described, are not adequately implied by so simple a name. For this reason it is called the Cashagua formation.

The Cashaqua formation is the most fossiliferous unit within the Naples group. The fauna is composed of pelecypods, gastropods and cephalopods, although a few brachiopods, arthropods, fishes and other organisms are represented. Most of the species found possessed stratigraphic or geographic ranges unsuitable for correlation purposes. However, the following faunal zones were noted, beginning with the lowermost:

1. *Paraptyx ontario-Loxonema noe* zone. A gastropod, *L. noe*, occurs in the lower portion of the Cashaqua from Cayuga Creek to Wyoming, where it is associated with *P. ontario*. This zone may be traced eastward into the Rock Stream member in the Bristol Center section by means of the latter species. *P. ontario* was not noted in the Middlesex section. This zone is just below a thin bed of black shale.
2. First *Palaeotrochus praecursor* zone. The gastropod, *P. praecursor*, defines a zone within the undivided Cashaqua of the Genesee Valley. This zone has been traced eastwardly to Bristol Center, where it occurs between the upper and lower tongues of the Rock Stream member. Farther east it becomes indistinguishable as these two tongues merge into one and the gray shales disappear. As *P. praecursor* reappears higher in the section, this is designated as the first *Paleotrochus* zone.
3. *Ontario suborbicularis* zone. The small and rather fragile valves of this pelecypod were encountered in sections between Cayuga Creek and Glenville.
4. Second *Palaeotrochus praecursor* zone. A second zone defined by this gastropod appears about 30 feet below the Cashaqua-Rhinestreet contact in the Wyoming section and persists eastward to Sawmill Creek, where it is found only a few feet below the Rhinestreet black shales.

The two *P. praecursor* zones occur in similar stratigraphic positions with respect to the tongues of siltstones of the Rock Stream member. They appear to form the most reliable guides for correlation within the Cashaqua. Corroboration of the faunal zones outlined above must await detailed mapping of the areas involved.

SAWMILL CREEK MEMBER

The name Sawmill Creek¹ is proposed for the gray and black shales that overlie the Middlesex and underlie the Rock Stream. The Sawmill Creek member may be identified from Honeoye Lake eastward to Seneca

¹ After submission of this paper for publication, Colton and de Witt (1958) proposed the name Pulteney for the unit herein named Sawmill Creek. The former name thus has priority.—*Ed. note*

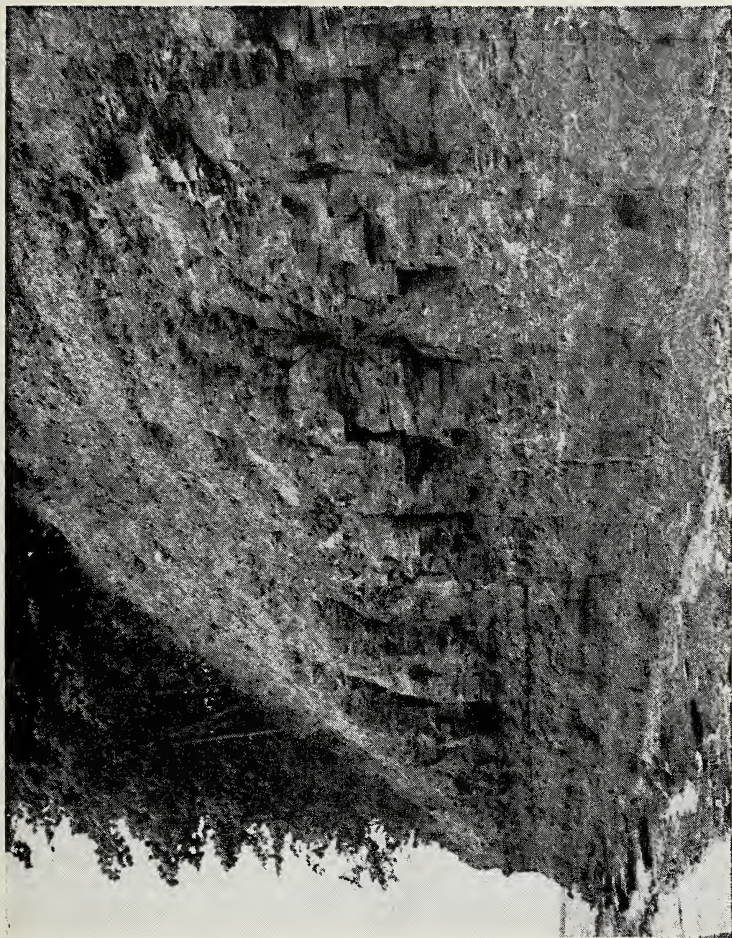


FIGURE 3. Genundewa-Cashaqua exposure 2 miles northeast of Sturgeon Point, Lake Erie. From the bottom: Genundewa limestone (on which man is standing), less resistant West River shales, blocky beds of Middlesex black shale and less resistant, lighter Cashaqua shale.

Lake, where it is found in Sawmill Creek, the type section, on the east side of Seneca Lake, eight miles north of Watkins. Exposures appear in the stream bed between the village of Hector and Logan Road, two miles to the east.

The Sawmill Creek shows a rather persistent eastward thickening with the following measurements recorded:

	SECTION	THICKNESS IN FEET
(West)	Honeoye Lake	19
	Bristol Center	77
	Middlesex	119
	Keuka Lake (west)	117
	Keuka Lake (east)	177
	Rock Stream	193
(East)	Sawmill Creek	236

This member is composed of interbedded, bluish-gray shale and black, fissile shale. Toward the east, thin siltstones appear and increase in number and thickness. Its beds form the faces of falls capped by the thicker, more resistant siltstones and sandstones of the Rock Stream member above (figure 4). In most of these exposures, black shales tend to be concentrated just below the Rock Stream, but do not appear to form a unit of sufficient homogeneity to warrant a separate name.

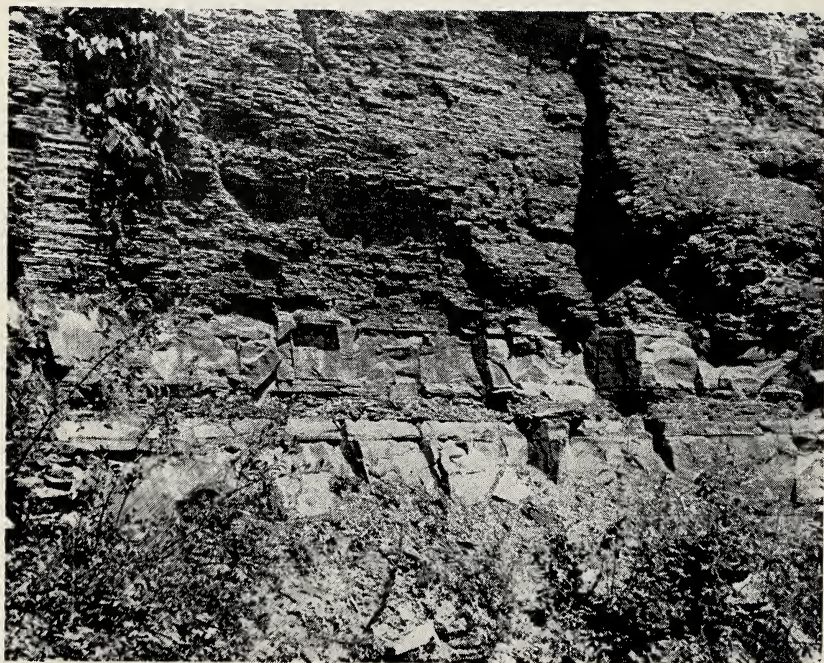


FIGURE 4. Sandstone beds about 3 feet thick in the Rock Stream member, Wagener Glen, Keuka Lake.

As the member thins westwardly, many of the black shales appear to merge with the Middlesex black shales below. Apparently the Sawmill Creek is equivalent in time to the upper Middlesex farther west, but is placed with the Cashaqua formation.

Fossils are rather uncommon in the Sawmill Creek. The latter contains pelecypods and cephalopods identical to those that occur in the shales of the Cashaqua to the west.

ROCK STREAM MEMBER

Bradley and Pepper (1938, p. 12) divided the "Cashaqua shale" in the Watkins and Ovid quadrangles into two parts—a lower portion, "all shale," and an upper, "a series of alternating flagstones and shale." For the upper sequence they proposed the name "Rock Stream flagstone member."

The Rock Stream may be traced from Seneca Lake to Conesus Lake, where it is represented by a few, widely spaced, thin siltstones. Near Seneca Lake it appears as massive beds of fine-grained, calcareous sandstone (figure 4). The following thicknesses have been noted:

	SECTION	THICKNESS IN FEET
(West)	Conesus Lake	29
	Honeoye Lake	45
	Bristol Center	94
	Middlesex	107
	Keuka Lake (west)	75
	Keuka Lake (east)	156
(East)	Sawmill Creek	199

This member is composed of two tongues. In the Bristol Center section the lower siltstones are overlain by a section of softer gray shales, which contain the first *Palaeotrochus praecursor* zone. In sections to the east, massive, calcareous sandstones may be found in two tongues of the Rock Stream member. The thin black-shale bed noted in the Cashaqua formation to the west may be traced eastward, where it disappears beneath the upper tongue of siltstones.

The fauna of the Rock Stream is composed of two parts. The soft gray shales contain some of the same species found in the shales of the Cashaqua formation to the west but in the massive, calcareous siltstones and fine-grained sandstones crinoid and plant fragments may be found. The thinner siltstones are barren.

RYE POINT MEMBER

The name Rye Point is here proposed for the fossiliferous, gray, calcareous shales that overlie the Rock Stream. The type locality is a small stream on the east side of Keuka Lake, three miles northeast of Ham-

mondsport and 1.5 miles northeast of Rye Point. The upper Rock Stream, Rye Point, and the overlying Rhinestreet may be examined by entering the ravine on the east side of East Lake Road, New York State Route 54.

The shales of the Rye Point thin toward the east and disappear from the sections in the Ithaca region. The following measurements have been recorded:

	SECTION	THICKNESS IN FEET
(West)	Honeoye Lake	113
	Bristol Center	62
	Middlesex	53
	Keuka Lake (west)	33
	Keuka Lake (east)	33
(East)	Sawmill Creek	15

The Rye Point is composed of calcareous shales in the western portion, but to the east its beds are less calcareous and more arenaceous. This member may be identified by the presence of the second *Palaeotrochus praecursor* zone and by a red and green, nodular limestone bed known as the Parrish limestone lentil. The latter, rarely more than one foot thick, was so named by Clarke and Luther (1904, pp. 29-30), apparently for its exposure in "Parrish gully at Parrish." The geologic map accompanying their report shows a few houses with the name "Parish." Clarke and Luther also refer to Parrish gully here assumed to be that gully located just to the east. The name Parrish is no longer found on topographic maps; the valley where it was located is now known as Parish flat, the gully as Conklin gully. However, the name "Parrish limestone" should be retained and the type locality understood to be in Conklin gully.

The type Parrish is a "lentil" within the Rye Point member. Elsewhere it may be one continuous bed or several lenses. A separate name seems appropriate because of its unusual character.

The Rye Point fauna is like that of the soft, gray shales to the west. *Manticoceras*, *Bactrites*, *Ontaria*, *Honeoyea*, *Palaeoneilo* and *Palaeotrochus* are genera represented.

RHINESTREET BLACK SHALE

Clarke (1903, p. 23) gave the name Rhinestreet to the black shales overlying the Cashaqua formation. The type locality is a cut along Rhinestreet, a road connecting Naples with the settlement of Seaman Hill to the north. Almost everywhere the basal contact with the Cashaqua is sharp and well defined whereas the upper contact is very irregular. The Rhinestreet black shales diminish in thickness eastward, being replaced by gray shales and siltstones of the Hatch formation. Rhinestreet black

shales show a slight westward thinning between Cazenovia Creek and Lake Erie. The following table summarizes these variations in thickness.

	SECTION	THICKNESS IN FEET
(West)	Lake Erie Composite	137
	Cazenovia Creek	152
	Tannery Creek	119
	Wyoming	72
	Beards Creek	63
	Mt. Morris-Letchworth Park.....	110
	Conesus Lake	69
	Honeoye Lake	36
	Bristol Center	29
	Middlesex	16
	Keuka Lake (west)	14
	Keuka Lake (east)	4
(East)	Sawmill Creek	15

Irregularities in the changing thickness are due, in part, to an interfingering of the black shales with the overlying Hatch. This contact is gradational and often arbitrarily placed.

The Rhinestreet has been described as a black shale, but its beds show minor variations in color and structure. Some beds are more fissile than others. Fossiliferous gray shale occurs in the lower part of the formation from the Genesee River to Tannery Creek. Fossils identified are: *Manticoceras sinuosum*, *Bactrites aciculum*, *B. gracilior*, *Buchiola retrostriata*, *Pterochaenia fragilis*, *P. fragilis* var. *orbicularis*, *Honeoyea major*, *H. erinacea*, *Praecardium vestutum*, *P. multicostatum*, *Lingula* sp., and *Styliolina fissurella*.

The name Attica shale was applied to the black shales in western sections by Chadwick (1919, p. 157) because the Rhinestreet here included more than that at the type locality. The Rhinestreet and Hatch at Naples were considered equivalent to the Attica in the west. This additional name does not seem necessary because age relationships are not criteria for the definition of a rock unit. Therefore, "Attica shale" is abandoned, and Rhinestreet is understood to be applicable westward to Lake Erie.

HATCH FORMATION

Gray shales, thin siltstones and black shales that overlie the Rhinestreet compose the youngest formation of the Naples group, and were given the name Hatch by Clarke and Luther (1904, p. 34). The type section is the lower part of Hatch Hill, one mile southeast of Naples. This

formation thickens from west to east as shown by the following measurements:

	SECTION	THICKNESS IN FEET
(West)	Tannery Creek	150
	Wyoming	154
	Mt. Morris-Letchworth Park.....	186
	Conesus Lake	267
	Honeoye Lake	253
	Bristol Center	265
	Middlesex	283
	Keuka Lake (west)	345
(East)	Keuka Lake (east)	418

In the west the Hatch is predominantly shale with a few thin siltstones. Eastward, however, the siltstones become thicker, more abundant and comprise a larger part of the formation. For this reason the word "formation" is used rather than the term "shale" or "shale and siltstone" (figure 5).

The westward equivalent of the Hatch formation is, in part, the Rhinestreet black shale. Upper Hatch is equivalent to the lower beds of the Angola shale (figure 5). Evidence for this lateral replacement is: (1) very thin, arenaceous beds appear in the lowermost Angola west of Tannery Creek; (2) the pelecypod, *Posidonia mesacostalis*, a common Angola fossil, occurs in the Hatch as far east as the Genesee Valley; and (3) the thickness of the Hatch is abnormally large in sections just east of the Angola shale.

The Angola shale does not belong in the Naples group. Its lower part may be correlated with the Hatch, but its upper portion is equivalent to the Grimes sandstone, Gardeau shales, Letchworth formation and Portage shale (Cooper, et al., 1942, chart 4). The upper contact of the Naples group should be placed at the base of the Grimes sandstone. Where the latter is absent, the top of the Rhinestreet may be so regarded.

The Hatch is overlain by Grimes sandstone to the east. Both may be traced to the Keuka Lake region. East of here, sandstones like those of the Grimes appear within the Hatch and the Hatch-Grimes contact is no longer identifiable. These sandstones contain a fauna similar to that of the Grimes.

The Hatch formation is rather unfossiliferous; only a few species have been noted in its gray shale. They are: *Manticoceras sinuosum*, *Buchiola retrostriata*, *Posidonia mesacostalis*, *Pterochaenia fragilis*, *Palaeoneilo* sp., and *Styliolina fissurella*.

CONCLUSIONS

Two major cycles of deposition are represented (in part) in the Naples group—each depositional cycle composed of three rock types: (1) black shale, (2) gray shale and (3) siltstone. One cycle is made up of black shale at the bottom and gray shale at the top. A wedge of siltstones lies between these two. The siltstone wedge thins westward, and where absent the black and gray shales are in direct contact.

The first or lower cycle is represented by (1) Middlesex black shale, (2) Cashaqua formation (undivided) and (3) Rock Stream member (a siltstone wedge). The second or upper cycle consists of the (1) Rhinestreet black shale, (2) Angola shale and (3) Hatch formation and Grimes sandstone (representing the lower part of a siltstone wedge). The Rock Stream siltstones reach only to Conesus Lake, but those of the Hatch formation extend almost to Lake Erie. Thus the depositional site of the second cycle was somewhat further west than that of the first.

Other parts of the Upper Devonian in western New York demonstrate this same relationship. For example: the (1) Genesee black shale, (2) West River shale and (3) Sherburne siltstones (Grossman, 1944, figure 2). Limited observations indicate that other examples may be present in Upper Devonian strata above the Naples group.

LITHOLOGY

Four major rock types have been recognized. They are: (1) black shale, (2) gray shale, (3) siltstone and (4) carbonates. Carbonates are the least common and occur as thin limestone beds, concretions and septaria. Gradations exist between all types. The term "shale" is used here as an indurated sedimentary rock composed of a mixture of silt-sized ($1/16$ - $1/256$ mm.) and clay-sized (less than $1/256$ mm.) particles, possessing a shaly parting.

BLACK SHALE

The term "black shale" is applied to rocks that have a very dark to black color and split into thin or fissile sheets. Black shales grade into lighter shales as noted elsewhere. Fresh rock is massive but becomes fissile if weathered. The black shale resists stream erosion and forms falls and rapids. Freshly broken specimens have an odor of petroleum and a thin oil film may occur where quiet water covers the rocks. Septaria and concretions are rare although septaria may be found in the lowermost beds of the Rhinestreet black shale. Fossils are also rare, and most of them are pyritized.

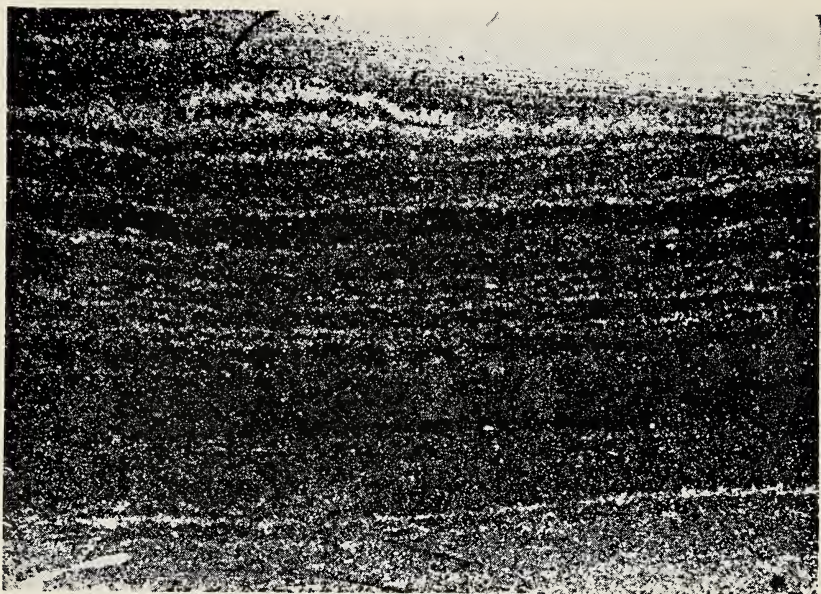


FIGURE 6. Photomicrograph of Rhinestreet black shale (X8), Whetstone Creek, 2 miles west of Honeoye, N. Y.

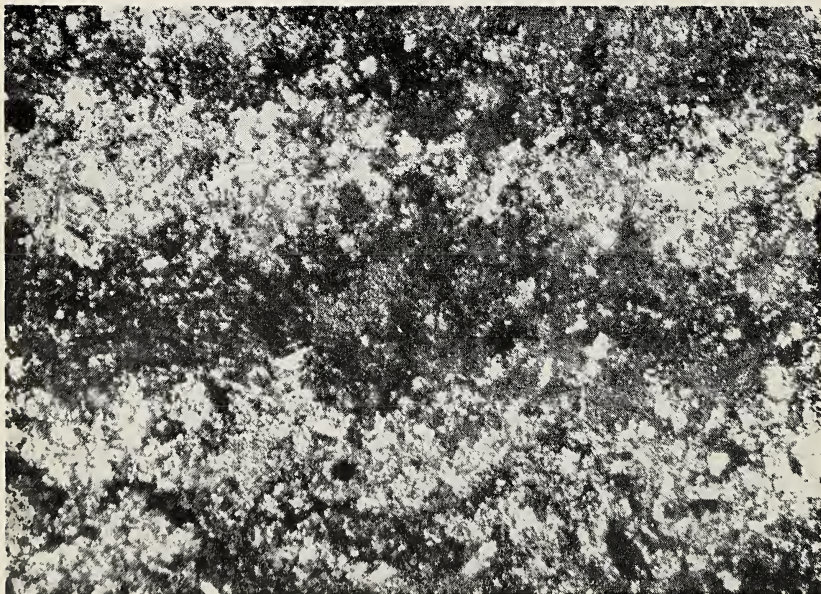


FIGURE 7. Same as Figure 6 (X75). White patches are quartz grains; darker portions are organic rich clays.

In thin section the black shales are both laminated and nonlaminated. Silt-size quartz particles form laminae that alternate with thicker layers of clay and dark brown bituminous matter (figures 6, 7). More rarely, laminae are formed by a variation in amount of organic matter, the clay and quartz content remaining constant. Quartz-rich laminae average 0.13 mm. and clay-bituminous laminae average 0.84 mm. in thickness. Some quartz-rich laminae are lenticular. Others have the grains concentrated in pockets and patches with the layering disrupted. The mineral composition of the shale is: quartz (0.004 mm. and larger)—30 percent, bituminous matter—10 percent, clay (0.004 mm. and smaller)—45 percent, chlorite and sericite—5 percent, pyrite—5 percent, and carbonate—5 percent.

Almost all the larger detrital grains are quartz, only six chert fragments having been noted in 25 thin sections studied. The quartz grains are angular, and many show strain shadows. Their irregular outline is displayed as (1) sharp, well-defined jagged edges, and (2) wavy, ill-defined surfaces. The former appears to be due to a lack of rounding; the latter to solution after deposition. Grains average 0.01 mm. in maximum diameter and range in size from those too small to measure with a micrometer eyepiece to those 0.04 mm.

Sericite and chlorite are concentrated in the quartz-rich laminae. Carbonate is rare but is more abundant if fossil fragments are present. Larger carbonate patches are rhombohedral in outline whereas smaller ones are irregular. Pyrite occurs as small euhedral crystals and larger, irregular, spongy masses. Under high power, the larger masses are composed of many small crystals, each with a definite euhedral outline. The edge of the mass may have short, stubby, fingerlike projections extending into the fine-grained matrix.

Fossils are not common in thin sections, excepting spores and plant fragments. The spores, now carbon, appear as oval to round bodies, the largest ones measuring 0.005 mm. Fragments of plant material assume varied sizes and shapes. Both spores and plant fragments are concentrated in bituminous-rich laminae.

Carbonate shells rarely occur in the black shale. *Bactrites* and *Styliolina fissurella* were identified; other shells can be recognized only as pelecypods. The latter are thin, crushed, and associated with the quartz-rich laminae. Some fossil fragments have a light brown, laminated, carbonate shell, the inside surface of which is lined with light brown carbonate rhombs that project toward the interior of the shell cavity. The remainder of the cavity is filled with clear, secondary carbonate. Pyrite crystals may be embedded in the light brown or clear carbonate or both. The pyrite transects all carbonate grain boundaries and is thus later than the secondary carbonate. This holds true for the pyrite in the matrix as well.

GRAY SHALES

The Naples group displays a rather heterogeneous array of shale types. These have been distinguished on the basis of their color, i.e. "light gray," "bluish-gray," "olive-gray," "dark-gray" etc. Appreciable amounts of quartz were detected in some so that the adjective "arenaceous" is used.

All gradations in color exist, and no sharp line may be drawn. Color is affected by variations in composition and severity of weathering. Organic matter seems to be one of the most important factors affecting color, darker shales having more organic matter. Variations in color due to weathering are caused by the oxidation of small amounts of iron sulfide. An example of the latter occurs in the shales of the Cashaqua formation. Some beds are bluish-gray on fresh fracture but become olive-gray after prolonged exposure.

Thirteen thin sections of shales from the Cashaqua and Hatch formations have been examined. One slide of a shale parting in the Hatch formation revealed significant differences that distinguish it from the others and will be discussed with the siltstones. The shales show thin, quartz-rich laminations interbedded with thicker clay and micaceous layers. The laminae are wavy with wrinkles confined to a single layer. Because of the fissility of the shale, it was necessary to cut almost all of the thin sections parallel to the bedding planes. As a result, no quantitative data on the thickness of the laminae could be obtained. From limited observations, the ratio of the quartz-rich to the clay-rich laminae is about the same as that observed in the black shales previously discussed. The most significant difference between the gray and black shales is the presence of wavy laminae in the former.

The estimated mineral composition of the gray shale is: quartz (greater than 0.004 mm.)—20 percent, bituminous matter—2 percent, clay (finer than 0.004 mm.)—35 percent, chlorite and sericite—20 percent, pyrite—3 percent, and carbonate—20 percent.

Large grains are present and have been identified as quartz by their refractive index. The grains are angular, and have an average maximum diameter of 0.006 mm., the largest noted being only 0.025 mm. Detrital quartz is less abundant than in the black shales. It increases in shales of a darker gray color.

Crystals and spongy masses of pyrite are present in the gray shales. Pyrite is concentrated in the quartz-rich laminae, and much of it occurs inside fossil shells (figure 8). As in the black shales, the spongy masses have euhedral crystals along the margins and fingerlike projections into the surrounding matrix. The interiors of cephalopod shells contain many euhedral crystals. Some shells may be completely filled, leaving only a

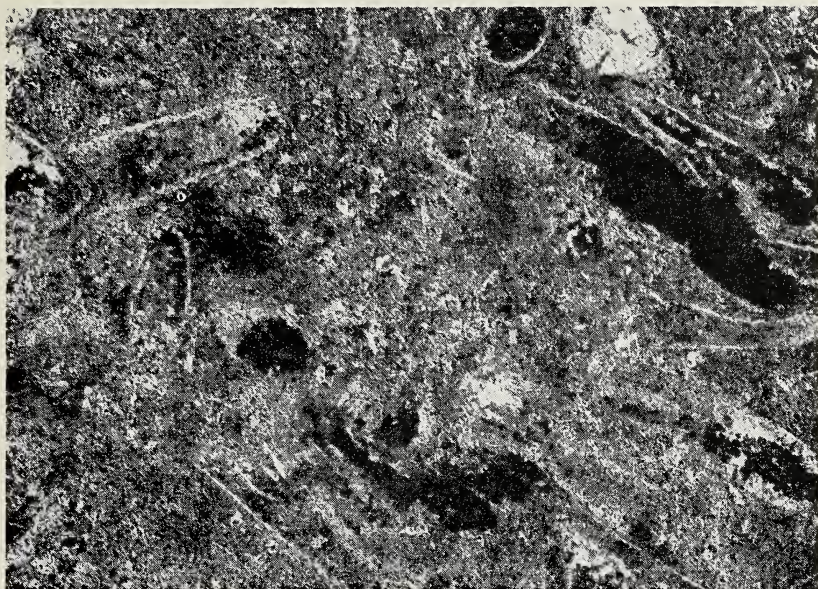


FIGURE 8. Cashaqua shale (X75), Hemlock Lake, N. Y. Black is pyrite, and light patches are carbonate and fossil fragments.

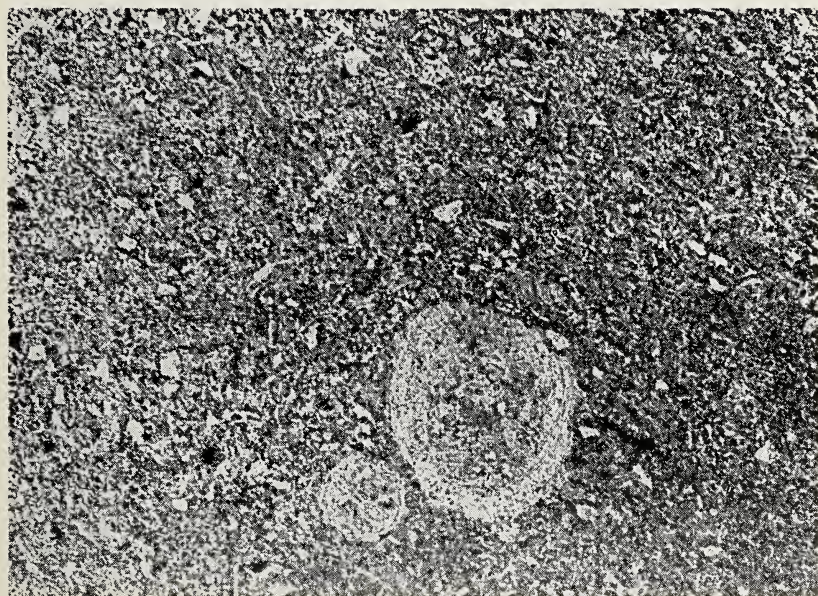


FIGURE 9. Cashaqua shale (X75) at Friend, N. Y. Spherulites in a matrix of tiny quartz fragments and chlorite.

thin carbonate layer around the outside. Limonite has been noted staining the matrix or concentrated along partings in the quartz-rich laminae. The amount of pyrite is less than in the black shales, ranging from one to five percent. Thus, it appears to be more characteristic of darker colored shales.

Carbonate is more abundant in gray shales than in black. It varies from 5 to 30 percent and is concentrated in the quartz-rich laminae. The carbonate is more abundant in fossiliferous shales but occurs even if carbonate fossil shells are absent. Spherulites of carbonate, noted in three slides, averaged 0.08 mm. in diameter; the largest one measured 0.2 mm. They are found in shales with a high carbonate content and are concentrated in the quartz-rich laminae.

Cross sections of cephalopod shells have a very similar appearance to the spherulites noted above. They are oval or circular in outline and are filled with carbonate crystals that formed on the inside of the shell. The optic orientation of these crystals is similar to that of the typical spherulite and forms a black cross under crossed nicols. The spherulites may be distinguished by a clear carbonate rim and light brown carbonate center (figure 9). This is the reverse of that found in the filled cephalopod shells.

Both sericite and chlorite are more abundant in the gray shales than in black. The sericite varies from 10 to 30 percent and the chlorite from 1 to 5 percent. Both minerals are more abundant and better oriented in the clay-rich laminae.

Organic components of the gray shales are spores, plant fragments, very fine organic matter and carbonate shells. Spores and plant fragments are less common in the gray shales than in the black. They are concentrated in the clay-rich laminae and increase in amount in darker shales. This increase is not itself sufficient to produce the color differences noted. Color differences appear to be due to differences in amount of very fine organic matter, darker shales containing more organic matter. The carbonate shells are more abundant in the gray shales and tend to be concentrated in the quartz-rich laminae.

SILTSTONES

The word "siltstone" is a field term here applied to fine-grained clastic rock that breaks with difficulty and forms conchoidal fractures if struck with a hammer. It is light gray to bluish-gray and weathers to a pale brown. The beds are 0.1 to more than 2 feet thick and are resistant, forming the caps of falls and rapids in ravines.

The siltstones are interbedded with gray shales; very rarely with black shales. If black shales are present, they are separated from the siltstones by some gray shale. If all three rock types are present, the typical sequence would be: (1) black shale interbedded with gray shale, (2) gray shale interbedded with widely spaced, thin-bedded siltstones, (3) gray shale interbedded with closely spaced, thin-bedded siltstones, (4) gray, arenaceous shale alternating with thick beds of siltstones and (5) gray shale interbedded with widely spaced, thin-bedded siltstones.

Several types of sedimentary structures occur on the underside of the siltstone beds. The first type discussed is called a lobate flow marking (figure 10). Hall (1843, p. 232) referred to these markings as "casts of flowing mud." He believed they were formed in two ways: some by mass movement of silt along the sea floor, others were casts of depressions previously hollowed out by flowing water. Clarke (1918, pp. 199-200) interpreted the markings as natural casts of deeply marked strand slopes, rilled and eddied by an ebbing tide. Rich (1950, p. 724) found similar markings in Silurian siltstones at Aberystwyth, Wales. He referred to them as "flow markings" and believed they were due to erosion by a moving abrasive fluid (water rendered abrasive by a heavy load of silt). Kuenen (1953, p. 1051) confirmed Rich's theory by noting that coarse grains had collected in the bottom of these grooves, and that the tapering, down-current direction exactly matches that of current bedding and ripple marks, where present. Thus they are formed by turbidity currents.

Parallel ridges form a second type of sedimentary structure observed on the underside of siltstones. These ridges are casts of grooves in the underlying sandy shales. They are parallel and, if associated with lobate flow markings, tend to be oriented in the same direction as the tapered ends. The ridges may vary in width from fine lines to several inches, the former being much more common. Hall (1843, pp. 234-237) noted that the marks were in an east-west direction at Lake Erie and northwest-southeast at Cayuga Lake. He believed they were caused by objects dragged over the sea bottom. Clarke (1918, pp. 209-210) suggested that the markings were caused by land ice brought down to the sea or by the landward thrust of sea ice. Rich (1950, p. 723) mentioned that small striations were present in the siltstones at Aberystwyth and ascribed them to abrasion by sand-laden water (turbidity currents).

The upper surface of some siltstone beds show current ripple marks, but others have an undulatory surface that reflects a folding of the laminae in the bed. Cross-bedding is common in the siltstone beds in the eastern sections.

Examination of 17 thin sections reveals two types of siltstones: (1)

Pelecypoda										
<i>Buchiola halli</i> (?)	2	16	1	1	3	1	1	1	5	O
<i>Buchiola retrostriata</i>	45		19	10	1	13	24			X
<i>Grammysia</i> sp.	1			1						
<i>Honeoyea erinacea</i>	2	1	1		1		1			X
<i>H. major</i>	2	1	1							X
<i>Lunulicardium ornatum</i>	2			1					1	O
<i>Lunulicardium</i> sp.	6	1	2	2	1	1	1	4		O
<i>Ontaria clarkei</i>	5	1	4			1	4			
<i>O. suborbicularis</i>	6	3	1	2		1	4		1	O
<i>Palaeoneilo lingulata</i>	1	1					1			O
<i>P. muricata</i> (?)	1		1				1			O
<i>P. petila</i>	2		2			1	1			O
<i>Paracardium doris</i>	3	1	2		1		1			O
<i>Paraptyx ontario</i>	5		3	2		1	1		1	X
<i>Posidonia mesacostalis</i>	1	1				1	3			O
<i>Praecardium multicostratum</i>	1	1				1				O
<i>Pterochaenia fragilis</i>	22	8	12	2	1	8	13			O
<i>P. fragilis</i> var. <i>orbicularis</i>	9	4	5			3	6			X
<i>Puella</i> sp.	3		3				3			O
Brachiopoda										
<i>Chonetes lepidus</i>	1		1			1	2			X
<i>C. scitulus</i>	2	2								X
<i>Lingula spatulata</i>	2	1	1		2					X
Others										
<i>Hyolithes neapolis</i>	2		2				2		1	X
<i>Primitia veriostrata</i>	1			1						?
<i>Protosalvinia huronensis</i>	4		4		4				2	X
<i>Crinoid fragments</i>	2			2					1	
<i>Tentaculites tenuinotus</i>	2	1		1					1	O
<i>Styliolina fissurella</i>	50	27	14	9	3	15	18		5	X
	286	111	107	68	9	81	143		32	

* Columns 11 and 12 represent strata below and above Naples group respectively. The X indicates fossil is present; O = form not reported.

laminated and (2) nonlaminated. Laminae may be observed in polished specimens cut normal to the bedding planes or in thin sections with the same orientation (figure 11). Some are caused by an alteration of quartz grains with chlorite and sericite; others are due to variations in organic content and concentration of pyrite. Organic material, mostly plant fragments, increases in the micaceous portions. Most of the pyrite is associated with quartz. The laminae average less than 1 mm. in thickness with a maximum of 3 mm. in an undisturbed bed.

A significant difference in grain size was observed between the two types of siltstone. Maximum diameters were measured in three thin sections of each type. The average maximum size was 0.04 mm. for the laminated and 0.08 mm. for the nonlaminated. The latter is coarser grained and might be called sandstone. Because the value of 0.08 mm. would fall in the very fine sand category, the term siltstone will be used to refer to both types of rock. The two types may be distinguished by their fractured surfaces. The laminated type tends to break parallel to the bedding, whereas the nonlaminated siltstone has a conchoidal fracture. A mineralogical analysis of each type is shown below:

	NONLAMINATED (percent)	LAMINATED (percent)
Quartz	45	40
Feldspar	2	1
Sericite	5	3
Chlorite	15	11
Biotite	3	1
Carbonate	19	30
Leucoxene	2	1
Epidote	tr.	tr.
Limonite	2	1
Sphene	tr.	tr.
Organic matter	1	1
Pyrite	1	1
Clay minerals	5	10
TOTAL	100	100

The quartz is angular; much of it is strained and filled with mineral inclusions. A few of the larger fragments form mosaics of interpenetrating grains. The largest grain measured was 0.35 mm. Some mineral inclusions appeared to be chlorite and sericite, but most were unidentifiable. Feldspar is rare in both types although some plagioclase was identified. The total amount was not greater than 2 percent in the nonlaminated type and less in the laminated type. The feldspar identified was unaltered (figures 12 and 13).

The carbonate content is higher in the laminated type and in general is greater for siltstones than for shales. It occurs as patches (never in layers) that may include several quartz grains. The entire patch acts as a crystallographic unit. Pyrite occurs in the same manner as in the shale,



FIGURE 10. Casts of lobate flow markings on the underside of siltstone beds in the upper Hatch just south of Hammondsport, Keuka Lake (east) section.



FIGURE 11. Siltstone with distorted laminae. Lowermost part of the Hatch formation, Sawmill Creek, Seneca Lake (X8).

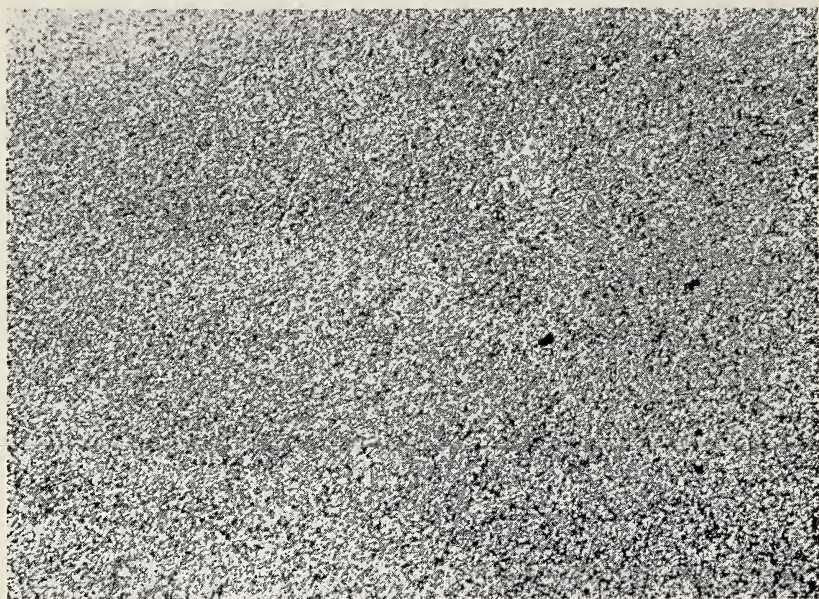


FIGURE 12. Nonlaminated siltstone (X8) Rock Stream member, Cashaqua formation, Bristol Center section.



FIGURE 13. Same as Figure 12 (X75), showing angular quartz grains, shreds of chlorite and sericite and finer clay matrix.

namely, as isolated euhedral crystals or in spongy masses composed of these cubes. The amount seems to be significantly less than in the shales. Limonite is present in all thin sections, staining the pyrite-rich laminae. Chlorite is more abundant than sericite, a reversal of their relationship in the shales. Biotite is present in small amounts. The fragments of these are larger and vary with the size of the quartz. The largest fragment of chlorite noted occurred in a nonlaminated siltstone and measured over 0.3 mm. The flakes are bent around detrital quartz grains and show frayed ends. Some of them must certainly be detrital because the clay content is low, thereby inhibiting the formation of large chlorite flakes. Their orientation is not completely random even in the nonlaminated siltstones although orientation is much better in the laminated types.

Fossils are very rare in the siltstones. Some small plant fragments occur, particularly in the laminated siltstones, but plant spores are rare, and only one carbonate shell fragment was noted. That fragment was part of a thick-shelled organism and was oriented parallel to the foliation of the micaceous minerals.

The siltstones are coarser grained than the adjacent shale partings and have less well-developed laminations. Chlorite and sericite are more abundant and better oriented in the shale. Shale partings associated with the siltstones are much more arenaceous than the shales in the Cashaqua formation where siltstones are absent.

The difference between the laminated and nonlaminated types appears to be a significant one. Whatever mechanism is called upon to deposit the strata must also account for the presence or absence of the laminae and the difference in grain size between the two.

CARBONATES

Two distinct kinds of carbonate rocks occur in the Naples group: a biostromal limestone (Parrish) and thin-bedded argillaceous limestone (found in the western sections of the Cashaqua formation). Carbonate concretions and septaria are also common in the Naples group.

The Parrish limestone forms a resistant bed less than two feet thick in the Rye Point member. It consists of reddish nodules in a green matrix and contains large numbers of carbonate shells. Soft greenish-gray shale occurs above and below the limestone. The shales below the limestone contain small concretions.

Four thin sections disclose a fine-grained carbonate and clay matrix enclosing numerous fossil shells (figure 14). *Styliolina fissurella* is the most common fossil. Interlocking carbonate rhombs form a small part of the matrix, but most of the carbonate occurs as spherulites and cavity fillings in fossil shells. The cavity fillings consist of radi-

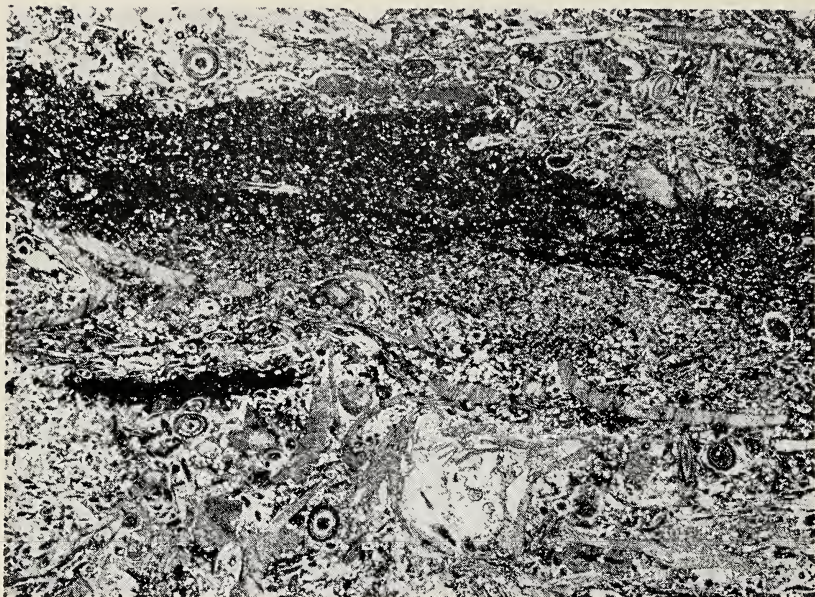


FIGURE 14. Parrish limestone (X8) in Cashaqua formation. Black portions are pyrite.

ating carbonate rhombs so oriented as to produce a "black cross" under crossed nicols. Many of the shell interiors are only partly filled with carbonate. The remainder of the space is occupied by a fine matrix that may include a stray detrital quartz grain. The carbonate rhombs were formed by a replacement of the matrix.

Angular, detrital quartz grains form less than 20 percent of the rock. They are rather large, many measuring over 0.1 mm. and are similar to those observed in the nonlaminated siltstones. Some of the largest are mosaics of smaller interlocking grains, and many have an extremely irregular outline suggesting partial replacement. A few grains of unaltered plagioclase feldspar were also noted.

Parts of the matrix are replaced by barite and pyrite. The barite occurs as irregular stringers and patches and is closely associated with the pyrite. Quartz grains, carbonate matrix, pteropod shells and spherulites form inclusions and embayments in the barite. Replacement by the barite was selective and occurred after the spherulites were formed. The pyrite forms spherical patches composed of euhedral crystals along the edges. These patches contain detrital quartz grains and, rarely, a spherulite. Good examples of replacement of barite by pyrite were observed in a thin section of the Middlesex black shale, but the relationship is not quite so obvious in the Parrish limestone.

The second type of carbonate rock is a thin, bluish-gray, argillaceous limestone. Beds of this type weather to a light brown and are found interbedded with the soft, bluish-gray shales of the Cashaqua formation, where they form less than 1 percent of the section. These limestone beds are very persistent. At some localities a bed may terminate and a row of concretions or septaria occupy the same horizon.

The limestone beds, concretions and septaria are important as stratigraphic markers. They are equally important because of the well-preserved and uncrushed fossils they contain. By contrast, fossils in the shales are crushed and broken. Early solidification of the calcareous masses may account for this difference.

The small ellipsoidal concretions contain very few fossils. One exception had a well-preserved specimen of the pelecypod, *Buchiola retrostriata*, in the center. This pelecypod was encased in barite that was, in turn, jacketed by a fine-grained carbonate matrix. In another specimen, blades of barite formed a vertical plane perpendicular to the long axis of the concretion.

The larger concretions (more than five inches in diameter) may contain many fossils. They consist of a band of fossil-rich limestone with upper and lower caps of barren carbonate. In many of these, fossils are pyritized. Pyritization may be selective, replacing one or two species, excluding the rest.

Concretions occur in some of the siltstones of the Hatch formation, some over 2 feet in diameter, and appear as low, rounded knobs that project above the upper surface of the bed.

FAUNA

Hall (1843, pp. 241-247) was among the first to describe fossils from the Naples group, listing 18 species. Many names have been added to the list so that now over 400 species are known from the Naples group or its equivalent in New York State. Williams (1844), Clarke (1898 and 1904) and others noted that distinct faunas existed in the Upper Devonian. These faunas and their stratigraphic positions are discussed below. The relation of the fossils in the Naples group to those in the Ithaca-Enfield group (Caster, 1933, pp. 201-202) is emphasized.

The term Portage was used for a stratigraphic unit in the Upper Devonian of western New York. Many workers, like Williams (1884), referred to the "Portage fauna," meaning the fauna in the Portage group of western New York. This fauna consists of pelecypods, cephalopods, and some gastropods. Crinoids, brachiopods and corals are very rare or absent.

In the Ithaca region, Williams (1884, pp. 29-31) noted the following faunal succession in the Upper Devonian: (1) Genesee slate fauna, (2) Portage group fauna and (3) Chemung fauna (figure 15). The Genesee slate fauna was represented by the brachiopods *Orbiculoidea lodensis* (as *Discina lodensis*), *Chonetes lepidus* (as *C. lepida*) and the pteropod *Styliolina fissurella* (as *Styliola fissurella*). The Portage fauna was "interstratified" with what Williams called the "Ithaca fauna and several sub-faunas." It was represented by *Buchiola retrostriata* (as *Cardiola speciosa*), *Goniatites*, *Hyolithes* and *Coleolus*. The Ithaca fauna is represented by *Martiniopsis laevis* (as *Spirifer laevis*) and *Palaeoneilo filosa*. A mixed Portage and Ithaca faunas give way to the Chemung fauna. Williams identified the Chemung fauna by the presence of *Cyrtospirifer disjunctus* (as *Spirifera disjuncta*), *Ambocoelia umbonata* var. *gregaria*, *Atrypa reticularis*, *Productella lachrymosa* and many others.

Clarke (1898 and 1904) called the fauna of the Portage group the Naples fauna. Life or bionic provinces were distinguished for the seas of "Portage time." The Oneonta province occupied the area east of the present Chenango River and was made up of estuarine or fresh-water deposits. An Ithaca province extended from the Oneonta province westward to the meridian of Cayuga Lake and was occupied by the Ithaca fauna. The Genesee province extended from Cayuga Lake to Lake Erie. It was occupied by the Naples fauna (figure 15).

The Naples fauna, described by Clarke (1898 and 1904), must not be confused with the fauna of the Naples group. The former is the fauna of the Portage group in western New York. This group, as defined then, included not only the present Naples group but also several hundred feet of strata above. Thus the fauna of the Naples group represents only a part of Clarke's original Naples fauna.

Clarke (1904, p. 211) recognized two subprovinces within the Genesee province: a Naples subprovince extending from Cayuga Lake to the Genesee River and a Chautauqua subprovince between the Genesee River and Lake Erie. The fossil list compiled by Clarke and Luther (1904, pp. 60-63) for the type section of the Naples is very different from the Ithaca fauna recorded by the same authors (1905a, pp. 61-65).

	NAPLES (type section)	ITHACA	NO. OF SPECIES COMMON TO BOTH
Crustaceans	4	8	0
Cephalopods	16	7	0
Pteropods	5	8	1
Gastropods	12	21	0
Pelecypods	25	84	2
Brachiopods	4	57	1
Corals	1	6	1 ?
Crinoids	1	3	0

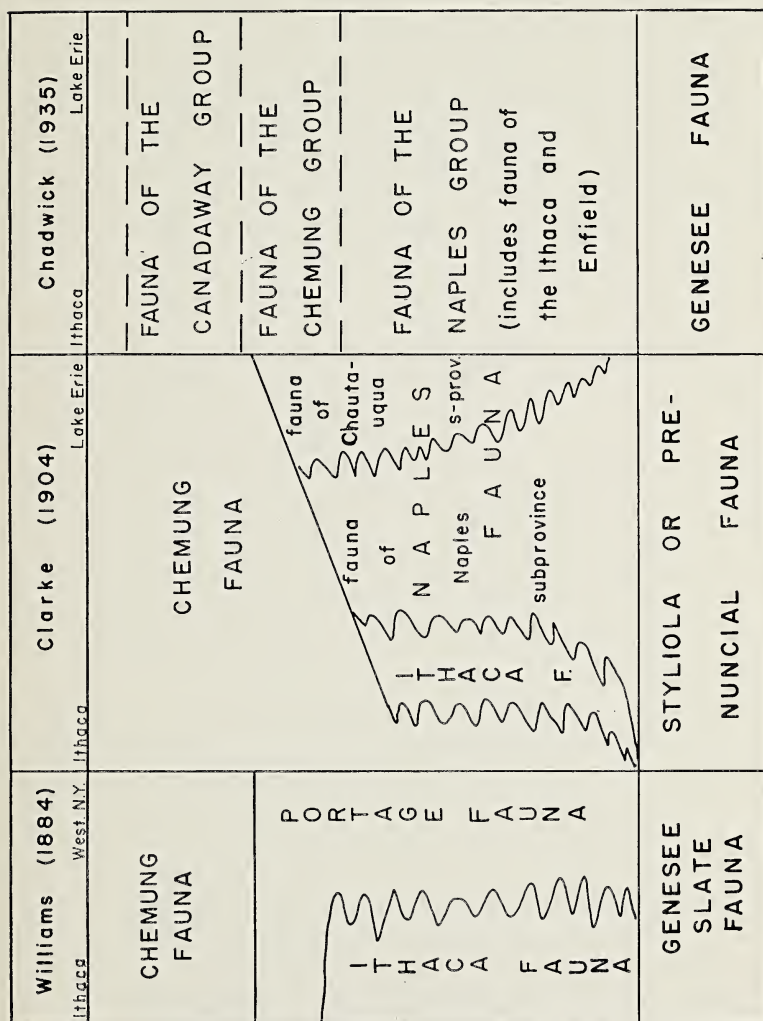


FIGURE 15. Relation of faunas.

In writing about the character of the Naples fauna, Clarke (1904, p. 215) stated:

Throughout the components of this fauna there is a striking homogeneity of character expressed in the fact that all classes of invertebrate organisms are thin shelled, a condition compromised solely by the presence of a few representatives from the adjoining fauna (Ithaca fauna) to the east.

Chadwick (1935, pp. 313-318) combined the Upper Devonian formations into seven groups, each group containing a distinct fauna. His faunal list for the Naples group included Clarke's list of fossils from the Naples subprovince and the Ithaca fauna. Chadwick's tabulation indicated that 185 species were restricted to the Naples group; 91 also occur in the Hamilton group, 51 in the Genesee group, and 76 carry on into younger strata. A total of 403 species is present in the Naples group or its equivalents.

The fauna of the underlying West River is very similar to that in the Naples group. Grossman (1944, p. 63) found *Pterochaenia fragilis* most abundant, but also listed as common: *Chonetes lepidus*, *Pleurotomaria rugulata*, *Buchiola retrostriata*, *Paleoneilo constricta*, *Paracardium doris*, *Ontaria suborbicularis*, *Bactrites aciculum*, *Manticoceras sinuosum*, *Probeloceras lutheri*, *Styliolina fissurella*, crinoid stems, and plant remains. These species are also present in the Naples group but in different proportions. *Chonetes lepidus*, *Paracardium doris*, and crinoid stems are uncommon. However, *Buchiola retrostriata* and *Bactrites aciculum* are abundant. Similarities of the faunas rather than slight differences seem to be most significant.

The Naples group is overlain by the Grimes sandstone, which carries a Chemung fauna. Clarke and Luther (1904, p. 63) noted that the following were present in the Grimes sandstone: *Protonympha devonica*, *Palaeochaeta salicifolia*, *Conularia* sp., *Paracyclas* sp., *Grammysia subarcuata*, *Aviculopecten cancellatus*, *Sphenotus* sp., *Orbiculoidea* sp., *Schizophoria impressa*, *Leptostrophia mucronata*, *Chonetes lepidus*, *Liorhynchus mesacostalis*, *L. globuliformis*, *Productella lachrymosa*, *Ambocoelia umbonata*, *Atrypa spinosa*, *Paropsonema cryptophylum*, and *Dictyospongia hoplea*. Only *Chonetes lepidus* is common to both the Grimes sandstone and the Naples group. Thus the faunal change is a sharp one.

This paper attempts to emphasize the stratigraphy and lithology rather than the paleontology. Over 1,000 fossil specimens were collected as the stratigraphic sections were measured and later identified. Most of the fossils were either interior or exterior molds, the original shell material having been dissolved away. The fine-grained rock matrix preserved many of their structural features.

The genera and species identified are listed in table 1, column 1. An approximate index of abundance (column 2) may be obtained by noting the number of times a species was found in the measured sections. This does not record the abundance of that species in any one described unit. For example, *Manticoceras sinuosum* may be represented in a given unit by three identifiable specimens, *Styliolina fissurella* by 30 specimens. Each would be recorded but once for that unit.

Pelecypods species were most abundant, followed by cephalopods, gastropods, pteropods and brachiopods. Among the pelecypods, *Buchiola retrostriata* was most common, followed by *Pterochaenia fragilis* and *P. fragilis* var. *orbicularia*. Of the cephalopods, *Bactrites aciculum* is most common, followed by *Bactrites gracilior* and *Manticoceras sinuosum*. *Palaeotrochus praecursor* is the most common gastropod. *Styliolina fissurella* is the most abundant fossil in the Naples group. Ammonoids are more abundant than their indices in table 1 would indicate, but the suture lines on many specimens were rarely clear enough to allow specific identification, and most of the shells were either crushed or significant parts were missing.

The geographic distribution of this fauna may be shown by arbitrarily dividing the Naples group into three geographic areas. A western area (table 1, column 3) comprises the sections from Lake Erie to Beards Creek. The central area (column 4) extends from the Mount Morris-Letchworth Park section to the Honeoye section. An eastern area (column 5) includes the sections from Bristol Center to Sawmill Creek.

Fossils are more abundant in the western sections. Some species are restricted to a limited geographic area; for example—*Loxonema noe*, which was found only west of the Genesee valley, or *Paraptyx ontario*, present only in sections east of the Genesee valley. The more common species were found throughout the Naples group. But even here variations in abundance occur; for example, *Bactrites aciculum* is more common in the western sections.

This fauna shows a definite relationship to the rock types (table 1, columns 6-10). It is very apparent in the field that fossils are common in the calcareous gray shales but rare in the black shales. They decline in abundance in the arenaceous shales, siltstones and sandstones. In calcareous shales their frequency is greater and species are more numerous. A few species occur in the more arenaceous beds. *Palaeotrochus praecursor*, *Manticoceras sinuosum*, *Bactrites gracilior*, *Buchiola retrostriata*, and *Styliolina fissurella* are examples. These appear to be somewhat more independent of lithologic changes.

Approximately 90 percent of the fossils collected came from the Cashaqua formation. Few changes in composition of the fauna were

observed from the bottom to the top of the Naples group. One exception is the pelecypod, *Posidonia mesacostalis*, which makes its first appearance in the Hatch formation. It is common in the Angola shales. Most of the species collected from the Naples group are present in the strata below and above (table 1, columns 11 and 12), according to Chadwick (1935, pp. 313-323). The more common species (table 1, column 2), such as *Manticoceras sinuosum*, *Bactrites aciculum*, *B. gracilior*, *Palaeotrochus praecursor*, *Buchiola retrostriata*, *Pterochaenia fragilis*, and *Styliolina fissurella*, also are found in the Angola shale.

The fossils of the Naples group represent, for the most part, a facies fauna. No species was found to be completely independent of lithologic changes. Only the gastropod, *Palaeotrochus praecursor*, showed some lateral persistence. It occurs in the soft, gray shales of the Cashaqua in western New York and the arenaceous shales of the easternmost sections. Thus, *P. praecursor* became the most reliable zone marker in the Cashaqua formation. The pelecypods *Ontaria suborbicularis* and *Paraptyx ontario*, and the gastropod *Loxonema noe*, also make good zone markers in the Cashaqua formation. An ammonoid, *Manticoceras sinuosum*, marks a faunal zone, occurring in dark gray shales a few feet above the base of the Rhinestreet black shale. *Posidonia mesacostalis*, a pelecypod, occurs in both the Angola shale and the upper part of the Hatch formation.

Several observations have been made concerning the character and paleoecology of this fauna: (1) it is different from the Ithaca fauna to the east; (2) it is associated with the gray shales and calcareous beds; (3) this fauna is characteristically thin-shelled; (4) it contains elements that may have been pelagic, as the pteropod *Styliolina fissurella* and the ammonoids; (5) this fauna lacks elements that were typically sessile—corals, crinoids and bryozoans are absent for the most part in the Naples group, but do occur in the Ithaca-Enfield group; (6) the fauna of the Naples group is an indigenous one, for if the fossils were swept in from elsewhere, their restricted geographic distribution and lithologic associations already described would not be expected.

ENVIRONMENTS

Three types of rock predominate in the Naples group: siltstones, black shales and gray shales. Differences in their geographic distribution, structures, textures and faunas demonstrate that a specific environment existed for each. The environment of each is reconstructed as far as present data will permit. An interrelationship of the environments is postulated.

SILTSTONE FACIES AND ENVIRONMENT

The siltstones facies is defined as the strata composed of interbedded sandstones, siltstones and arenaceous shales, which make up the Rock Stream member and the Hatch formation. This facies is best developed in the eastern part of the Naples group and interfingers with black and gray shale facies to the west.

SEDIMENTARY STRUCTURES AND TEXTURES

Crossbedding of a larger scale is present in a few of the siltstone beds, most pronounced in the eastern sections but rare to absent in equivalent strata to the west. It is interpreted as evidence for deposition in relatively shallow water. Siltstones to the west were deposited in deeper water because this crossbedding is rare to absent.

Small-scale crossbedding is present in many of the thin, laminated siltstones to the west. Kuenen (1953, p. 1051) found this type of crossbedding common in fine sandy or silty materials deposited by turbidity currents. This crossbedding may take the form of low-angle, wavy laminae or appear as steeply dipping laminae along the base of the bed. Both types have been observed in the Naples siltstones, but the former is much more common.

The upper surfaces of many siltstones show well-developed ripple marks. Interference ripples were also noted. Sheldon (1928, p. 243) found that channels formed by current scour are associated with ripple marks and large-scale crossbedding in the "Portage" at Ithaca. Ripple marks are much less common in the western sections of the Naples group. This decrease in abundance of large-scale crossbedding and ripple marks from east to west indicates that the water was shallower in the east.

In the Naples siltstones, parallel ridges are closely associated with lobate flow markings. Both structures occur in beds that lack large-scale crossbedding and ripple marks. They are most common in siltstones that are west of, but correlate with, crossbedded and ripple-marked siltstones and sandstones. Turbidity flows were the cause of the lobate flow markings and parallel ridges.

Short rodlike ridges are found on the underside of some siltstones. They are casts of depressions made in soft mud. Hall (1843, p. 241) referred to them as "marine vegetation or fucoids," giving them the name *Fucoides graphica*. Clarke (1918, pp. 205-207) believed that they were impressions of ice crystals. Flower (1955, p. 861) suggests they may be depressions formed by cephalopods coming to rest in the soft mud. The markings show no preferred orientation. Rapid burial by a turbidity flow explains their preservation.

Two types of siltstone are recognized in the Naples group: the non-laminated and laminated types. Both are poorly sorted, contain angular quartz particles, and occur in rather thin beds of uniform thickness over considerable distances. Both types may have lobate flow marking and parallel ridges. The nonlaminated type was produced by a turbidity current. It is more difficult to explain the laminated type in this way. Kuenen (1953, p. 1050) offers a reasonable explanation:

But in many instances there are dozens of laminations involved with strongly contrasting compositions. So large a number of more or less separate flows, each with a different composition can hardly be assumed. The obvious explanation of this type of lamination is that the load was carried forward by traction along the bottom. A strong local sorting action can then develop. That traction may become important in turbidity currents is confirmed by the development of small scale current bedding and of ripple mark . . . Tentatively the writer suggests that this occurs when the current becomes more dilute with a relatively high (but absolutely low) lutite content and a small amount of larger particles. The lutite load must be sufficient to cause flow under influence of gravity.

If the nonlaminated and laminated siltstones are compared, the laminated type shows: (1) a smaller amount of sand- and silt-size quartz particles, (2) a smaller amount of biotite, chlorite and sericite fragments, (3) a larger amount of clay minerals, (4) a smaller average grain size, and (5) small-scale crossbedding.

The observations listed above agree with Kuenen's explanation of what might be expected in the laminated beds. The thicker nonlaminated siltstones represent the first deposits from a flow. Downslope, the thinner, laminated beds are deposited by traction. This is borne out by field observations in the siltstone facies. The tongues of siltstone that first appear in the westernmost sections are composed of a thin, laminated bottom and a thin, laminated top. As the last vestiges of the flow moved over sediments already deposited, the diluted residual may have been moved along by traction producing the observed laminations.

A few examples of "slump structure" were noted in the siltstone beds with flow markings. "Slump structure" includes overthrusts, underthrusts and twisted beds, according to Kuenen (1953, pp. 1054-1058). They are due to horizontal movement of slope deposits after deposition. Slump structures are cited as evidence that at least some of the siltstone beds in the Naples group were slope deposits.

FAUNA

Fossils are very rare in the siltstones. Only a few specimens were collected from the interbedded arenaceous shales and shaly partings. These were forms characteristic of the fauna in the Naples group (table 1). Elements of the Ithaca fauna were absent. The siltstone facies was not a suitable environment for the extensive development of either the Ithaca fauna or the fauna of the Naples group.

CONCLUSIONS

1. Some of the siltstones in the easternmost sections were deposited in shallow water, but those to the west were deposited in deeper water.
2. All siltstone beds, except those with large-scale crossbedding and ripple marks, were deposited by turbidity flows. The nonlaminated types were carried along in suspension. The laminated types were carried forward by traction and represent the downslope equivalents of the nonlaminated type.
3. The siltstone facies were deposited in an environment that was not suitable to the Ithaca fauna or the fauna of the Naples group.

BLACK SHALE FACIES AND ENVIRONMENT

The black shale facies of the Naples group is represented by the Middlesex and Rhinestreet black shales. These shales are thickest in the western sections and thin eastward. If traced eastward, the shales correlate with the lower part of the siltstone facies. Black shales alternate with gray shales in the western sections where the siltstones are absent.

The black shale facies in the Naples group correlates with part of a much thicker section of black shales to the west. Cooper, et al. (1942, plate 1) show that the Ohio black shale (Ohio), Kettle Point black shale (southwest Ontario Province), "Huron" black shale (northwest Ohio and southeast Michigan), Delphi black shale (north-central Indiana), "Antrim" black shale (Michigan) and the New Albany (southern Indiana and northern Kentucky) are equivalent, in part, to the Naples group. Any environmental conditions postulated must take into account this extensive area of black shales.

SEDIMENTARY STRUCTURES AND TEXTURES

Laminations are present in much of the black shale. Silt-size quartz particles form laminae that alternate with thicker layers of clay and dark brown bituminous matter. The silt-size quartz particles average 0.01 mm. in maximum diameter compared to 0.04 mm. in the laminated silt-

stones and 0.08 mm. in the nonlaminated siltstones. Silt-size quartz particles make up only 30 percent of the black shale compared to 40 percent in the laminated and 45 percent in the nonlaminated siltstones. Clay makes up 45 percent of the black shales and 5-10 percent in the siltstones.

Many theories have been proposed to account for laminations in black shales. Hard (1931, p. 177) believed the laminae were formed by "agitation." He added that compaction and differential settling obscured all evidence of this agitation. Bradley (1931, p. 320 ff.) compared the Genesee black shale with other black shales and concluded that the couplets of laminae were varves formed by a cyclic supply of organic material controlled by climatic changes. Bradley (1929, p. 102) suggests that variations in amount of rainfall might indirectly form laminae. Rubey (1930, pp. 40-41) mentions storms, floods and shifts in marine currents as possible causes. It has been impossible to determine the cause of the laminations in black shales of the Naples group.

Crossbedding, ripple marks, flow markings and slump structures are absent in the black shales. The absence of these features and the extreme regularity of the laminae suggest deposition took place below the zone of effective wave action.

FAUNA

Fossils are rare in the black shales. Only *Styliolina fissurella*, *Lingula spatulata*, the spore *Protosalvinia huronensis*, and plant fragments were found. The black shales are interbedded with fossiliferous gray shales. It is concluded that conditions that existed during the deposition of the black muds were not conducive to the development of a fauna such as is found in the gray shales.

The Ithaca and Enfield faunas existed to the east of the area of black shale deposition. Any conditions postulated for the development of black muds must take into account these marine faunas.

CONCLUSIONS

1. The black shales were deposited below the zone of effective wave action.
2. A low oxygen content existed in the water during the accumulation of the black muds. The high organic content, absence of fossils, and secondary pyrite are evidence of this. The rarity of limestones in the black shales is interpreted as evidence that a low pH existed at the same time.
3. The black shales were deposited in deeper water than that in which the Ithaca and Enfield faunas existed to the east. The waters were stratified, and black muds were formed where the oxygen content was low.

GRAY SHALE FACIES AND ENVIRONMENT

The gray shales are thickest in the western sections of the Naples group. They correlate with the upper portion of the siltstone facies to the east. Arenaceous gray shales are interbedded with the siltstones in the eastern sections.

SEDIMENTARY STRUCTURES AND TEXTURES

Most of the gray shales are laminated. Thin quartz-rich layers alternate with thicker clay layers. Large-scale crossbedding and ripple marks are absent. Small-scale crossbedding is found only in the more arenaceous shales. The laminae tend to be wavy in the gray shales. In a few places the laminae are disrupted by microchannel fillings. The wavy laminae and microchannel fillings are interpreted as evidence of weak current activity.

Bituminous matter makes up only 2 percent of the gray shales compared to 10 percent in the black. Variation in the color of the unweathered shales, that is from gray to black, is due to variable amounts of organic matter. This variation in organic content might be explained in several ways: (1) an increase in sedimentation rate may cause a dilution of organic matter, (2) the supply of organic matter may change, and (3) the available supply of oxygen at the bottom may vary.

In the first case, should the sedimentation rate increase, one might expect a direct ratio between the thickness of the lamina and the color. Just such an increase in sedimentation rate may explain the virtual absence of black shales in the eastern sections compared to equivalent strata to the west. Approximately 130 feet of dark gray to black shale (Rhinestreet) is believed to be contemporaneous with 300 feet of dark gray to gray shale (Hatch) in the Keuka Lake region.

In the second case, smaller biotas yield a smaller supply of organic material. It may be recalled that the gray shales are contemporaneous with black shales in the adjacent regions to the west. If there were differences in biotic development, organic matter in the surface waters must have been very irregular in distribution. Strong surface currents would have to operate to maintain this irregular distribution. The gray shales were found to have a definite correlation with the upper part of the siltstone tongues. Such a correlation could hardly be explained by the erratic behavior of surface currents.

In the third case, the available supply of oxygen could change due to changes in circulation of the water. As circulation increases, the bottom-most layers receive more oxygen from the surface waters. More carbon is oxidized, and the muds become lighter. This seems to be the most

plausible explanation and is supported by observations in the faunal changes discussed below.

Carbonate occurs in variable amounts in the shales. A decrease in carbonate in the darker shales is interpreted as evidence for a decrease in the pH of the water during deposition of the darker muds.

FAUNA

The fauna of the Naples group consists of pelecypods, cephalopods and gastropods for the most part. Corals, echinoderms and brachiopods (except for the genera *Chonetes* and *Lingula*) are absent. Most of the species present are rather thin shelled and small. Fossils are virtually absent in the black shales, rare in the dark gray shales, and most abundant in the light gray shales, calcareous shales, and biostromal limestones (Parrish limestone).

The fossils of the Naples group represent an indigenous fauna, and the species are different from those in the Ithaca fauna. Fossils are rare in the siltstone facies, but should be abundant if they were carried in by currents.

The attitude of the fossils shows that only weak currents operated during the deposition of the gray muds. Many valves of the pelecypods, such as *Buchiola retrostriata*, were found oriented with the convex side down representing an unstable position. The conical shells of the straight cephalopod, *Bactrites*, showed random orientation on the bedding planes.

CONCLUSIONS

1. The gray shales were deposited in a zone below effective wave action. The absence of large-scale crossbedding and ripple marks as well as the unstable position of the pelecypod valves are evidences for this.
2. The faunal population and the amount of bituminous matter were controlled in part by the oxygen content of the water. The oxygen content increased when circulation increased. If sufficient circulation occurred, most of the bituminous matter was oxidized, a thin-shelled pelecypod-cephalopod fauna was maintained and gray muds with wavy laminae and microchannel fillings were deposited. If circulation decreased, more bituminous matter was deposited, the fauna decreased in population and species, and darker muds with less wavy laminae were deposited. With circulation at a minimum, almost no faunal life existed, and black shales with straight laminae were deposited.

3. The pH of the water presumably varied as shown by a decrease in carbonate content in the darker shales. Reduced circulation of water was probably responsible for this change.
4. It is impossible to determine to what extent the pH controlled the population of the fauna. The presence of thin, unfossiliferous limestone beds in the black shales would indicate that at times the pH was not too low. With the fossils absent, it might be assumed that a low oxygen content, and not low pH, was the factor responsible.

RELATIONSHIP OF THE ENVIRONMENTS

The interrelationship of the environments is important in understanding the facies relationships of the Upper Devonian of New York. Rich (1951) gives a valid explanation of his observations in the Cascadilla gorge at Ithaca. He postulates three depositional environments: (1) unda, (2) clino and (3) fondo.

The unda environment is subjected to repeated agitation by waves and currents, throwing finer material into suspension. The wave base is the critical factor here, and that part of the sea floor subjected to this agitation is called the "undaform." The second environment is the clino environment or slope, extending "from wave base down to more or less deeper parts." The land form is called the "clinoform" and demonstrates freedom from wave-caused disturbances. "Muddiness, great and oft-repeated variations in sediment supply, deposition dominantly from suspension, density currents . . . gravity slides and/or intra- or interstratal flowage . . ." are typical features. At the base of the clinoform is the fondoform. The fondo environment is quiet, although it may be disturbed by general currents and by density currents descending from the clinoform.

Rich (1951, pp. 9-14) suggests criteria for recognizing rocks deposited in each of these environments. For the unda, he suggests that (1) grains could range in size "from gravel through sand to coarse silt," (2) the composition could be conglomerate, sandstone, coarse siltstone, fragmental limestone, oölite or coquinite, (3) moderately thin bedded, and (4) contain either wave or current ripple marks, crossbedding etc.

For the clino environment, the criteria are: (1) silt or clay material, (2) interbedded siltstones (one-half to 10 inches thick) and shales, (3) even bedding and laminations, (4) fluting and striations (flow markings) and (5) internal crumplings of the laminations of the siltstone beds.

Criteria for recognition of rocks in a fondo environment are: (1) universally fine sediments (except for organic remains), (2) clay, shale, calcareous or siliceous oozes and (3) even bedding tending toward massive.

These criteria may be applied to the rocks of the Naples group. The criteria for the fondo environment fit the black and gray shale environments represented by the Middlesex black shale, Cashaqua formation (in the western sections) and the Rhinestreet black shale. The presence of gray or black muds in the fondo environment is explained by changes in oxygen content of the water due to changes in circulation. The criteria suggested for a clino environment then apply to the shales and siltstones of the Hatch formation and Rock Stream member of the Cashaqua formation. The strata formed in the unda environment are possibly represented by some parts of the Ithaca and Enfield formations to the east. The difficulties in correlating the Naples group with the strata to the east may be explained by the difference in depositional environment postulated above.

Additional study of the Upper Devonian of New York may show that other formations exhibit a similar pattern. The black and gray shales (examples: Geneseo black shale, West River shale, Angola shale) may represent deposits in a fondo environment. The thin-bedded siltstones (example: Sherburne siltstone) could be deposits in a clino environment. The thicker bedded siltstones and sandstones (example: Grimes sandstone, near Naples, N.Y.) may represent deposits in an unda environment. If future studies substantiate this theory, the complex facies changes in the New York Upper Devonian may be more easily correlated and interpreted.

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APPENDIX

Keuka Lake (east) Composite Section

The lower part of the Naples Group is well exposed in a northward flowing stream 1.5 miles east of Grove Springs on the east side of Keuka Lake two miles south of Bluff Point. The Rock Stream member may be observed in the stream where it is crossed by the Grove Springs-Wayne Road.

The section occurs in a northwestward flowing stream 1.2 miles southeast of Urbana. It is 1.3 miles northeast of Rye Point on the east side of Keuka Lake and exposes the upper portion of the Rock Stream member and Rye Point member of the Cashaqua, the Rhinestreet and lower Hatch. The upper Hatch may be examined in the northward flowing stream located directly south of Hammondsport. The Grimes sandstone crops out in the stream 1.3 miles south of Hammondsport.

UNIT	DESCRIPTION	THICKNESS (FT.)
	Covered above	
	Grimes Sandstone	
70.	Siltstone, noncalcareous to exceedingly calcareous, massive and crossbedded (beds average one foot in thickness), with thin arenaceous shale partings.....	23.1
	MEASURED GRIMES	23.1
	Hatch Formation	
69.	Shale, dark bluish gray, interbedded with an occasional thin siltstone	11.5
68.	Covered	8.0
67.	Shale, arenaceous, dark bluish gray, irregularly bedded, with many plant fragments	2.6
66.	Alternating beds of calcareous siltstone, bluish gray weathering to brown and bluish gray arenaceous shale.....	4.1
65.	Covered	22.5
64.	Siltstone, calcareous, bluish gray, crossbedded to massive and laminated	18.5
63.	Shale, dark gray to light bluish gray with two rather thick siltstone beds 3.6 feet from base.....	7.6
62.	Shale, black, thin bedded.....	0.9
61.	Shale, dark bluish gray to bluish gray interbedded with a few thin siltstones	5.5
60.	Siltstone, slightly crossbedded, laminated crossbedding.....	0.7
59.	Dark bluish gray argillaceous to arenaceous fossiliferous shale interbedded with an occasional thin siltstone. Noted were: <i>Manticoceras sinuosum</i> , <i>Buchiola retrostriata</i> , and plant fragments	9.2
58.	Alternating bluish gray, crossbedded, calcareous siltstone and dark bluish gray, fissile arenaceous shale.....	26.5

UNIT	DESCRIPTION	THICKNESS (FT.)
57.	Siltstone, calcareous, bluish gray, even bedding with thicknesses of beds up to 1.1 feet.....	7.5
56.	Shale, arenaceous, bluish gray, with a few thin siltstone beds decreasing in number toward the top.....	16.0
55.	Siltstone, calcareous, light bluish gray, massive throughout except for crossbedding at top. Massive bed at base contains large concretions	4.3
54.	Covered	14.0
53.	Alternating beds of bluish gray, arenaceous shale and massive medium gray calcareous siltstones up to 1.3 feet thick.....	29.0
52.	Shale, argillaceous, dark gray, irregularly bedded, fossiliferous	10.3
51.	Shale, arenaceous, bluish gray, interbedded with a few thin bluish gray siltstones.....	9.5
50.	Covered	5.0
49.	Shale, arenaceous, bluish gray, interbedded with a few thin bluish gray siltstones.....	9.8
48.	Shale, argillaceous, dark gray, irregularly bedded, interbedded, with a few arenaceous shales. Argillaceous shales contain <i>Monticoceras</i> sp., <i>Buchiola retrostriata</i> , <i>Grammysia</i> sp.....	10.5
47.	Arenaceous, bluish gray shales with occasional thin siltstone beds up to 0.2 foot.....	42.5
46.	Siltstone, bluish gray, thin even bedding at bottom, massive toward top. Two beds with shale partings.....	1.0
45.	Alternating beds of arenaceous, noncalcareous, gray to dark gray, crossbedded shale and calcareous, crossbedded to massive siltstones. Siltstones are more abundant than in 44, and shales become more argillaceous and darker toward the top of the unit	48.7
44.	Shale, bluish gray, argillaceous to arenaceous with a few thin beds of black shale and bluish gray, crossbedded siltstones, 0.1 to 0.2 foot thick.....	22.7
43.	Siltstone, calcareous, bluish gray, crossbedded at top, massive below, grooves and undulations on underside.....	0.4
42.	Gray arenaceous shale interbedded with bluish gray siltstones (up to 0.2 ft. thick). Both interbedded with dark gray to black argillaceous shale	31.5
41.	Alternating beds of gray, argillaceous, thin bedded shale and very thin siltstone beds.....	19.0
40.	Shale, black, fissile, alternating with thin beds of gray argillaceous shale	2.5
39.	Covered	3.6
38.	Alternating beds of black and gray argillaceous shale with thin siltstone beds 3 feet from the base of the unit. No fossils were noted	13.1
TOTAL HATCH FORMATION		418.5
Rhinestreet Black Shale		
37.	Shale, black, thin bedded, nonfossiliferous.....	4.0
TOTAL RHINESTREET		4.0

UNIT	DESCRIPTION	THICKNESS (FT.)
Cashaqua Formation		
Rye Point Member		
36.	Shale, slightly calcareous, arenaceous, irregularly bedded with a few thin, crossbedded siltstones in the lower part. A few small concretions occur in the top. Fossils noted were: <i>Manticoceras sinuosum</i> , <i>Bactrites gracilior</i> , <i>Orthoceras</i> sp., <i>P. praecursor</i> , <i>Palaeoneilo</i> sp., <i>Ontaria suborbicularis</i> , <i>Lunulicardium ornatum</i>	10.0
35.	Limestone, argillaceous, bluish gray and reddish brown, nodular with crinoid fragments abundant. The lower two feet are more argillaceous, but upper foot shows red and green color throughout. Only nodules in lower part show color variation. (Parrish limestone lentil?)	3.0
34.	Shale, slightly calcareous, dark gray, irregularly bedded, with numerous concretions measuring up to 3 inches in diameter. No fossils noted.	20.0
TOTAL RYE POINT MEMBER		33.0
Rock Stream Member		
33.	Siltstone, calcareous, bluish gray, crossbedded with thicker beds massive (up to 1.3 feet). The interbedded calcareous shales are arenaceous and light bluish gray. Fossils noted were: <i>Manticoceras sinuosum</i> , <i>Bactrites gracilior</i> , <i>Styliolina fissurella</i>	22.6
32.	Alternating beds of purplish brown, slightly calcareous siltstone (up to 1.2 feet thick) and dark gray, thin bedded shale.	20.3
31.	Shale, black, fissile, nonfossiliferous.	0.4
30.	Shale, arenaceous, slightly calcareous, bluish gray to dark gray, bedding irregular, fossiliferous with <i>Manticoceras sinuosum</i> , <i>Bactrites gracilior</i> , <i>Palaeotrochus praecursor</i> , <i>Pleurotomaria</i> sp., <i>Phrogmostoma incieum</i> , <i>Buchiola retrostriata</i> , <i>Paraptyx ontario</i> , <i>Styliolina fissurella</i> noted.	25.1
29.	Siltstone, calcareous, bluish gray, massive (to 1.2 ft.), with arenaceous dark gray shale partings.	11.8
28.	Shale, dark gray and thin flags.	10.2
27.	Siltstone, bluish gray weathering to brown, bedding massive in lower part becoming crossbedded and finally thin bedded at top. Plant fragments common.	3.9
26.	Shale, arenaceous, bluish gray, bedding thin and smooth to lumpy and irregular.	25.1
25.	Alternating beds of bluish gray to dark gray shale and thick, massive siltstone beds with crinoid fragments. Shales more arenaceous in upper part. Large concretions at top.	14.9
24.	Shale, bluish gray, thin bedded.	1.6
23.	Siltstone, light bluish gray, medium bedded.	2.0
22.	Shale, bluish gray, thin bedded.	4.1
21.	Siltstone, slightly calcareous, light bluish gray, massive.	1.0
20.	Shale, bluish gray, thin bedded.	5.3
19.	Thin siltstone beds separated by bluish gray shale.	1.5
18.	Alternating bluish gray and dark gray shales.	3.5
17.	Siltstone, noncalcareous, bluish gray, massive.	1.0
16.	Shale, black, thin bedded.	1.6

UNIT	DESCRIPTION	THICKNESS (FT.)
15.	Siltstone, noncalcareous, bluish gray, massive.....	0.3
	TOTAL ROCK STREAM MEMBER	156.2
	Sawmill Creek Member	
14.	Shale, black fissile.....	7.5
13.	Interbedded bluish gray, fissile shale and thin calcareous, cross-bedded, bluish gray siltstones.....	59.5
12.	Shale, noncalcareous, irregularly bedded.....	22.7
11.	Siltstone, noncalcareous, bluish gray, laminated fissile.....	0.3
10.	Shale, dark bluish gray, thin bedded.....	4.9
9.	Siltstone, noncalcareous, bluish gray, laminated fissile.....	0.3
8.	Shale, dark bluish gray, thin bedded.....	4.5
7.	Shale, dark gray to black, thin bedded.....	66.5
6.	Siltstone, calcareous, black, thin irregular beds separated by dark gray shales.....	1.5
5.	Shale, dark gray, thin bedded.....	9.7
4.	Siltstone, bluish gray, fissile, nonfossiliferous.....	0.1
	TOTAL SAWMILL CREEK	177.5
	TOTAL CASHAQUA	356.7
	Middlesex Black Shale	
3.	Shale, black, fissile, nonfossiliferous.....	12.1
2.	Shale, dark gray to black, with thin arenaceous calcareous beds	2.9
1.	Shale, black, thin to irregularly bedded.....	54.3
	TOTAL EXPOSED MIDDLESEX	69.3
	Covered below	

Sawmill Creek Section

Sawmill Creek is a westward flowing stream on the east side of Seneca Lake 6.2 miles north of Watkins, N. Y. The Middlesex is exposed 0.25 mile east of the Lehigh Valley Railroad. The contact of the Sawmill Creek and Rock Stream members may be observed just east of the bridge on Logan Road. The Rhinestreet and lowermost Hatch are exposed in the portion of the stream just west of an abandoned road, one mile northeast of Logan.

Hatch formation

45.	Alternating beds of dark bluish gray, arenaceous shale, black fissile shale, and dark gray micaceous crossbedded siltstone...	7.8
	TOTAL MEASURED HATCH	7.8

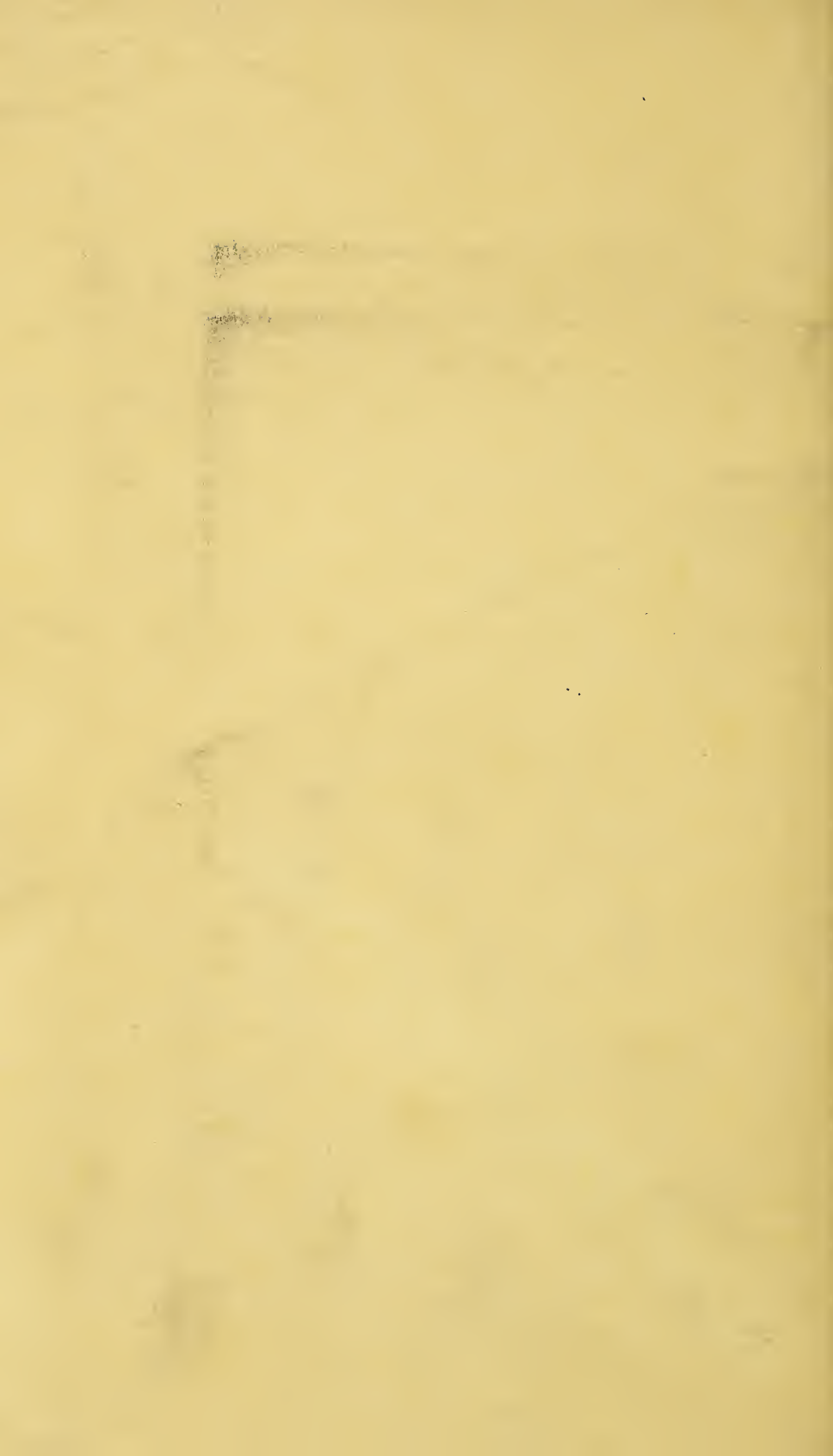
Rhinestreet Black Shale

44.	Shale, black, bedding thin to fissile, slightly micaceous.....	3.7
43.	Siltstone, calcareous, dark gray, crossbedded, slightly micaceous	0.4
42.	Shale, black, bedding thick to thin, slightly micaceous, interbedded with a few very thin siltstones.....	10.8
	TOTAL RHINESTREET	14.9

UNIT	DESCRIPTION	THICKNESS (FT.)
Cashaqua Formation		
Rye Point Member		
41.	Shale, argillaceous, calcareous, dark gray to bluish gray, very irregularly bedded, fossiliferous with <i>Manticoceras</i> sp., <i>Bactrites gracilior</i> , <i>Orthoceras</i> sp., <i>Ontaria suborbicularis</i> , <i>Honeyeya major</i> (?), <i>Lunulicardium</i> sp.....	11.0
40.	Shale, arenaceous, calcareous, medium bedded in nonfossiliferous parts, irregularly bedded where fauna was collected. Thin limestone beds and concretions throughout. Noted were: <i>Palaeotrochus praecursor</i> , <i>Bactrites gracilior</i> , and <i>Palaeoneilo</i> sp.	17.0
39.	Limestone, argillaceous, bluish gray.....	0.7
38.	Shale, arenaceous, dark bluish gray, with concretions two feet above the base.....	4.5
37.	Irregularly bedded bluish gray, arenaceous shale and calcareous siltstone	12.0
TOTAL RYE POINT MEMBER		45.2
Rock Stream Member		
36.	Siltstone, calcareous, crossbedded, bluish gray weathering to brown	18.0
35.	Covered	30.9
34.	Shale, bluish gray, thin bedded with a few thin siltstones.....	4.8
33.	Covered	10.3
32.	Alternating beds of gray, argillaceous shale and crossbedded to massive, thick (up to 2.0 ft.) calcareous siltstone.....	35.8
31.	Alternating beds of bluish gray shale and thin beds of siltstone (up to 0.3 ft.)	15.5
30.	Shale, argillaceous, light bluish gray, thin even bedding.....	8.5
29.	Shale, arenaceous, light bluish gray, irregularly bedded. <i>Pterochaenia fragilis</i> noted.....	5.9
28.	Covered	23.2
27.	Interbedded bluish gray arenaceous shale and massive beds of bluish gray, calcareous siltstones. Concretions in center of unit	11.2
26.	Alternating beds of bluish gray, thin bedded arenaceous shale and argillaceous shale of the same color.....	5.0
25.	Covered	18.0
24.	Alternating beds of bluish gray, arenaceous shale and very thin bluish gray siltstones.....	11.9
23.	Siltstone, bluish gray, massive.....	0.6
TOTAL ROCK STREAM MEMBER		199.6
Sawmill Creek Member		
22.	Shale, argillaceous, black, fissile.....	6.0
21.	Alternating beds of bluish gray, argillaceous shale and very thin siltstone beds.....	4.0
20.	Covered	4.1
19.	Alternating beds of bluish gray, argillaceous shale, black shale, and very thin siltstone beds.....	7.0

UNIT	DESCRIPTION	THICKNESS (FT.)
18.	Siltstone, calcareous, light bluish gray, massive.....	0.9
17.	Shale, arenaceous, dark bluish gray, irregularly bedded.....	39.7
16.	Siltstone, calcareous, light bluish gray, massive.....	0.3
15.	Shale, arenaceous, dark bluish gray, irregular bedding.....	4.6
14.	Siltstone, calcareous, light bluish gray, massive.....	0.4
13.	Shale, light bluish gray, thin to irregular bedding.....	11.7
12.	Siltstone, calcareous, light bluish gray, massive.....	1.5
11.	Shale, somewhat arenaceous, fissile to arenaceous, interbedded with fissile to massive siltstone beds occasionally throughout..	45.9
10.	Siltstone, noncalcareous, dark bluish gray, crossbedded, nonfossiliferous	0.4
9.	Alternating beds of dark bluish gray, arenaceous shale, black fissile shale and a few thin siltstone beds (occasionally a massive one)	58.0
8.	Covered	45.0
7.	Alternating beds of bluish gray siltstone (0.4 ft. each) and bluish gray, arenaceous shale. One-foot bed of massive siltstone at base	6.2
TOTAL SAWMILL CREEK MEMBER		235.7
TOTAL CASHAQUA		480.5
Middlesex Black Shale		
6.	Shale, argillaceous, black, fissile.....	6.5
TOTAL MIDDLESEX		6.5
Genesee Group		
Sherburne Sandstone Formation		
5.	Alternating beds of bluish gray shale, some black fissile shale and thin siltstone beds (up to 0.1 ft.).....	8.5
4.	Alternating beds of black fissile shales and thin beds of purplish gray siltstone.....	10.5
3.	Alternating beds of bluish gray laminated calcareous siltstone (0.2-0.3 ft.) and bluish gray arenaceous shale (0.4-0.5 ft.). Shale becomes more abundant and fissile in upper part.....	9.5
2.	Shale, bluish gray, thin bedded with a few interbedded siltstones	23.3
1.	Siltstone, calcareous, bluish gray, massive beds, no fossils noted	9.8
TOTAL RECORDED SHERBURNE		61.6





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t **ANNUAL REPORT**
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Contents

	PAGE
General Statement	7
Accomplishments of the Surveys.....	14
The Museum	29
Special Services	49
Publications	56
Appendixes	59

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DONALD M. LEWIS.....Junior Scientist

EUGENE C. OGDEN.....State Botanist, Associate Scientist

RALPH S. PALMER.....State Zoologist, Associate Scientist

Geological Survey

JOHN G. BROUGHTON.....State Geologist, Principal Scientist

DONALD W. FISHER.....State Paleontologist, Associate Scientist

Y. WILLIAM ISACHSEN.....Associate Scientist (Geology)

WILLIAM LYNN KREIDLER.....Senior Scientist (Geology)

TERRY W. OFFIELD.....Scientist (Geology)

LAWRENCE V. RICKARD.....Senior Scientist (Paleontology)

ARTHUR M. VAN TYNE.....Scientist (Geology)—Wellsville Office

State Museum

VICTOR H. CAHALANE, *Assistant Director*

Curatorial

ROGER L. BORST.....Senior Curator (Geology)

CHARLES E. GILLETTE.....Associate Curator (Archeology)

CLINTON F. KILFOYLE.....Associate Curator (Paleontology)

EDGAR M. REILLY, JR.Associate Curator (Zoology)

STANLEY J. SMITH.....Associate Curator (Botany)

JOHN A. WILCOX.....Associate Curator (Entomology)

VACANT.....Associate Curator (Interpretation)

Exhibits

EDITH FROELICHMuseum Technician (Temporary)
LEWIS E. KOHLER.....Museum Technician
LOUIS J. KOSTER.....Senior Museum Technician
THEODORE P. WEYHE.....Museum Exhibits Designer

School Services

JUDITH A. DRUMM.....Museum Instructor
VACANTMuseum Education Supervisor

Library

EILEEN COULSTON.....Librarian (Temporary)

Clerical

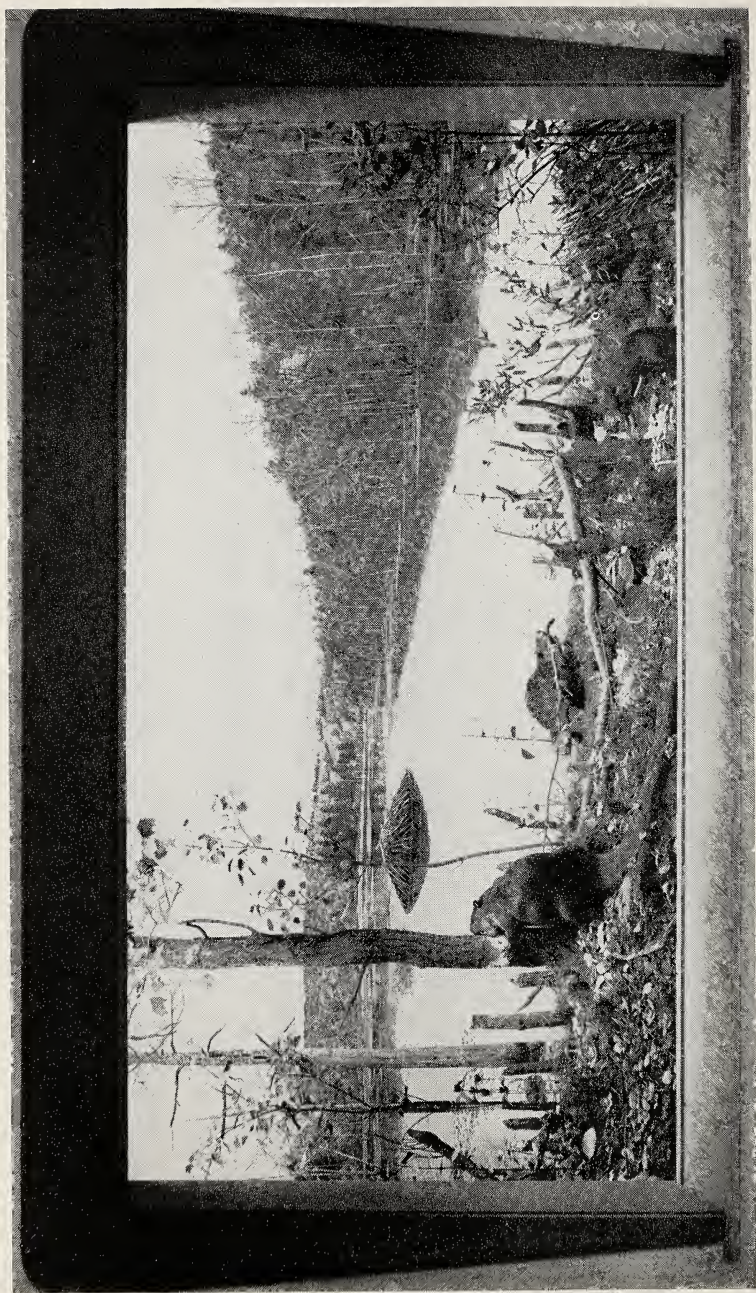
MARGARET BASSOTTI.....Stenographer
MARION B. BENDER.....Clerk
JOAN A. CREECH.....Stenographer
EMILY W. DIXON.....Typist
JOSEPH T. KILLEA.....Mail and Supply Helper
ROSELLE LITHCOWClerk
MARJORIE R. SCHMIDT.....Principal Clerk
MARGARET SLATER.....Senior Stenographer
MARY C. STEARNS.....Stenographer
EILEEN A. WOOD.....Senior Stenographer

Guards

JAMES CARROLLMuseum Guard
JOHN C. CUNNINGHAM.....Museum Guard
FRANCIS J. LYNCH.....Museum Guard
WILLIAM C. ZIMMER.....Museum Caretaker

* * *

JOHN HELLERPhotographer
NELSON D. POWERS.....Maintenance Helper
JACOB SMALLENBROEKCarpenter



"Life at a Beaver Pond," a new habitat group, was recently completed. The scene is a pond in Schoharie County.

General Statement

I HAVE THE HONOR TO SUBMIT a report of the major activities and accomplishments of the New York State Museum and Science Service for the year ended June 30, 1959.

The year covered by the 121st Annual Report witnessed advances toward fulfillment of policies outlined in the published statement of last year. These may be summarized under five headings from the Deputy Commissioner's inventory paper at the June Staff Conference:

1. An entire museum hall devoted to a major field is being renovated.
2. The climate for basic research has definitely improved.
3. It was suggested that the Science Service develop a "team approach to projects." This recommendation has been carried out in several ways and is exemplified in the preparation of the State geologic map.
4. The student honoraria program has been strengthened as a means of encouraging science talent. Higher quality people representative of a larger number of universities are now being attracted to this program. Awards were made to 11 out of 38 applicants (Appendix A).
5. The backlog of old research reports has been printed and current projects are being carried through to publication promptly. Bulletins of the Museum and Science Service have achieved international recognition and have been requested and reviewed in Britain, Russia, Poland and Japan.

Accomplishments engender new proposals. The philosophy which motivates our program aspirations, and which is reflected in the current budget proposal, again comprised part of the Deputy Commissioner's "major proposals for programming in cultural education and special services," made at the same conference:

1. The Department must advance vigorously its conviction that program goals in cultural and scientific areas have equal priority with other areas of Departmental concern. Improving the climate for acceptance of basic research as a program is a State as well as a National concern. The progress we have made in the Department during the past five years should be communicated to the budget. There is growing public acceptance for research.

2. Grouping related disciplines into the three Surveys of the Science Service has facilitated teamwork on major projects. It has fairly balanced support between geology and biology and underlined the needs in anthropology. In order to determine whether certain diseases of the forest have animal (insect) or plant (fungus) origins, our entomologists and botanists need the cooperative services of a mycologist full time. To salvage archeological remains on the rights-of-way of highways to be built with Federal grants to the State, we need a second full-time archeologist, and an aide to work in the laboratory.
3. Though the geography of the State has not been substantially changed, the population has increased from 15,000 aborigines to 15 millions of persons in 350 years. Man's use of the land has radically altered its resources, and his conception of how resources should be expended or conserved is changing constantly. So concepts of subsurface geology, of mineral resources, of glacial deposits, of fossil fuels, of underground storage and new sources of energy evolve with advancement of geological science. Commercial development in seeking new solutions to old problems, awaits publication of research findings on new problem areas. Our State Department of Commerce, for the first time in 50 years, will be able to show to prospective industries a summary of present knowledge of the geological resources of the State when in the next fiscal year this Department publishes the new State geological map which it has in preparation.
4. For the first time since Theodore Roosevelt opened the State Museum in 1916, the staff looks confidently to a significant plant expansion. The new laboratories in the wing afford research facilities hitherto unavailable for new research undertakings in experimental and systematic biology and its conservation correlates, geochemistry and its relation to the origin of mineral resources and rocks, and human prehistory. We may expect the staff of the State Science Service, in cooperation with universities and other State agencies, to pursue new lines of inquiry of interest to the taxpayers. New projects will require new funds beyond those now available and programmed.
5. The Museum will also have new planning and preparation laboratories. The Department may look for speedup in renovation of exhibits hall by hall. Scientists are cooperating to shorten the lifeline between discovery and interpretation. Attendance has risen to 175,000. With an expanded school services program, we may anticipate a demand for a new facility in a more accessible

location by seeking planning funds for a Museum Center to house all cultural and scientific activities of the Department. All costs of the project will approach \$10,000,000; \$20,000 of preliminary planning money is the immediate requirement.

Having given the gist of what is done and what we propose, it may be helpful to provide depth for otherwise bald statements.

The report of the Museum, written by the Assistant Director, poignantly relates how rate of procurement and staffing affect progress in exhibits. But any progress toward renovation accomplished in four years is appreciated by a visiting public which has expanded by 35,000 over last year. Are we going to keep them waiting until 1964 to finish the Hall of Ancient Life, now under construction? It is estimated that each museum visitor who is held overnight in the community adds \$15 to the economy. If but 10 percent of State Museum visitors are held in Albany by this attraction, we are making an appreciable contribution to the local economy. Culture seems to be important business.

The improved reporting of Department activities in the press has brought people to Albany. The Museum has shared in the increased coverage. *Bulletin to the Schools*, alone, carried stories of three new exhibits: the coelacanth, a living fossil fish, which came from the Natural History Museum of Paris; the beaver habitat group, which opened in December and has proved a great favorite; and the Earth—Our Ship in Space. The latter two were indeed cooperative efforts of many talents in the museum and scientific community, utilizing advice of some of the country's top scientists. The introduction of chamber music on Sundays in July and August, in cooperation with the American Federation of Musicians, brought Haydn's "Sunrise Quartet" into a natural history setting, and, though not well-publicized, attracted some new visitors. It is an open question whether Sunday afternoon concerts might go better in winter. The whole matter of summer vs. winter opening should be investigated; "600 days" in summer are uncommon since the Thruway was completed.

The scientific resources of the Museum grow with the increase of collections. Notable new collections are reported by the curator of botany, through his own collecting activity and by gift. Over a thousand plant specimens of the flora of Ulster County were donated to the herbarium by Henry F. Dunbar of Kingston; and several hundred fungi of Cattaraugus County were given by William C. Denison.

Recognition of the importance of the systematic collections at the New York State Museum came in holding the Second Conference of Directors of 22 research museums of natural history at Albany in October. The Education Department and the State Museum were hosts,

with the Assistant Commissioner for State Museum and Science Service serving as general chairman. A grant from the National Science Foundation assisted in the expense of the conference. Among the objectives attained by this gathering was a statement of the importance of systematic biology in the national interest. An organization of directors of such establishments is another. A third objective was to suggest ways and means by which natural history museums may realize their potential as resources for the advancement of basic research in the United States; such museums possess significant collections, they have scientific staffs; they actively pursue research; and they publish it. These institutions fulfill the classic definition of a museum: a place of study,¹ and by inference a community of scholars.

The value of the research conference to review results and decide whether to search further, when some breakthrough is imminent, was demonstrated by the geologists in holding a peripatetic colloquium on the Taconic problem. Similarly, anthropologists from the Northeastern and Southeastern States met in a daylong symposium on Cherokee and Iroquois cultures at the annual meeting of the American Anthropological Association in Washington, to which the State Archeologist and the Assistant Commissioner contributed papers. These acts of scientific leadership on the part of our personnel are typical of the kind of professional activity listed in the appendixes (Appendix B).

How a scientist spends his time, in cooperation with others or in personal research, is largely a matter of individual inclination or policy. It depends on the person and it depends on the project. Should a scientist devote his productive years to compiling and editing the work of others, passing up opportunities for individual research? This is the old question of the inventory and the need of bounding ranges. The encyclopedic handbook is a most useful service to the world. The policy question is whether to free the man to do it.

The appearance after five years of the first volume of the *Handbook of North American Birds*, which the report of the State Zoologist anticipates, is awaited with keen interest. Meanwhile the first scientific report from the small mammal survey by Dr. Paul Connor is in hand and will go to press soon.

How a scientist may bloom in a new environment under the stimulation of unlimited research facilities is demonstrated in the State Botanist's report of researches on pollen at the Brookhaven National Laboratory. Development of techniques of tagging and sampling ragweed pollen should be carried to the next logical step, when actual research

¹ After the great institution for literary and scientific studies built by Ptolemy I at Alexandria. Transaction of the Albany Conference of Directors of Systematic Collections, October 13-14, 1958. [W. N. Fenton, (Ed.)] 20 pp.

on dissemination begins. Control depends on it. Presumably the National Institutes of Health will want this project extended.

The successful researches of the State Entomologist and his associates into the biology, life cycle and control of biting insects not only won them international recognition but led to the anonymous gift by a family of grateful citizens, of \$7,000 for research on "punkies" (*Culicoides*). The proceeds of this gift were accepted by the Regents as the Adirondack Entomology Research Fund.

There is no better indication of research accomplished or meritorious original work than publication. Pressure to publish is often decried in teaching situations, and it can result in premature delivery of intellectual monsters. But it is a poor teacher who makes no original inquiries, and research for service alone leaves no record for the man or his institution. Service activities bulk large in the work of an organization like the Science Service (Appendix C); but we are also a community of scholars who are freed of teaching to do research, and from such a group scientific and scholarly contributions are expected. Besides service reports to other State agencies, which should be written in clear and concise English, the monographic and educational series of the Department have first claim on the staff who, it is presupposed, will also be contributing idea papers to professional journals, articles to encyclopedias, and an occasional book or literary piece for the general reader. Such writing is a habit that is learned and from it derive "the pleasures of publishing".¹ The shorter bibliography for this year—6 in official and 10 in outside media—suggests momentary deprivation.

Administrative demands on the time of busy scientists to fill out forms: self-evaluation survey, questionnaires from the Budget Office, the Governor's Office—besides the reports to other fund-granting agencies—occupied the whole staff during December and January. Like group therapy such inquiries are disturbing experiences and affect productivity adversely. To convert losses into gains, problems posed in the returns of the curators were thoroughly aired and discussed in a meeting with the Assistant Director. The organizational issue is the separation of the museum functions from research with which the curator identifies and which is the function of Science Service. The curators are scientists in their own right and should be given some time and recognition for individual research. They are also closely tied to exhibits and interpretation. Their reporting relationship to the Assistant Director was reaffirmed.

Several staff changes have occurred during the course of the reporting year. Y. William Isachsen was appointed provisionally on July 3, 1958,

¹ The title of the Columbia University Press newsletter.

to the position of associate scientist (geology). The position of senior curator (geology) was filled on September 25 with the appointment of Roger L. Borst. Donald L. Collins received permanent appointment to the position of principal scientist (biology) on April 9, 1959. Arthur N. Van Tyne received his permanent appointment to the previously reclassified scientist (geology) position on May 21, 1959, and Paul F. Connor was appointed permanently to the position of scientist (zoology) on March 26, 1959. Judith Drumm became museum instructor on September 11, 1958, filling the position made vacant by the resignation of Barbara Alberts. Similarly, on February 26, 1959, James Carroll replaced David Mattas as building guard. Two stenographic positions made vacant by the promotions of Grace Smith and Sandra Van Olpen, were filled by the appointment of Margaret Bassotti on October 9, 1958, and Joan A. Creech on January 1, 1959. Nelson Powers on May 21, 1959, replaced Jay Fredette, who resigned from the position of maintenance helper on May 6, 1959. The position of scientist (entomology), occupied by Dr. Hugo Jamnback, was reclassified to senior scientist, in recognition of the research program he had developed and its importance to the public. At the close of the year, the position of museum education supervisor and the reclassified position of associate curator (interpretation) remained vacant due to the resignation of Ruth Rubin on January 15, 1959, and the retirement of Walter J. Schoonmaker on September 30, 1958.

There has been a certain noticeable foot-dragging toward acceptance of section 233, Education Law, providing for the issuance of permits for recovery of archeological and paleontological remains on State lands. Thirty-five permits have been issued and promptly countersigned by the Department of Public Works. It is hoped that, in the next few years, legal and other questions can be set aside for the benefit of the citizen scientist.

To improve communication and facilitate planning, the heads of surveys and the Assistant Director of the Museum have met regularly with the Assistant Commissioner. Plans for the new laboratories in the wing and "the move," as we have come to call it, have kept us busy. Location of telephones, disposition of equipment, priorities in the removal of collections to locations near the "bridge of sighs" to the wing have been prime considerations. The first thing was to relocate the herbarium in the back of Biology Hall, as related by the Assistant Director and the curator. This is the start on an improved research facility, although it means loss of some exhibits space. It entailed refiling whole genera of plants, employing an aide for the curator, who is correspondingly delayed with accessions and identifications. The

imminent displacement of other collections underscores the need for aides to the curators.

Prospective removal of scientists to a new research facility has set them to planning new kinds of research that will make our establishment a State center for basic research and service. The Regents declined President Deane W. Malott's invitation to a merger at Cornell University. The pros and cons of this exciting proposal were thoroughly gone over here and in Ithaca, and, as a consequence, our position in Albany has been strengthened. The best part of it all was the expression of affection in the local community for the retention of the State Museum in the Capital area. We thanked the Chamber of Commerce for its interest with an open house on December 2.

Writing an annual report is essentially a threshing operation. Reading a journal yields some grain, it detects some straws in the wind, and leaves chaff on the floor. There was the day the State Library reading-room ceiling was reported falling, but like "Henny Penny's" London sky, the rumor was happily exaggerated. The movers of the herbarium were exonerated, we learned the bearing capacity of the floor in Biology Hall, and admitted it had been overloaded for 40 years. One Monday a woman in West Sand Lake had found an "alligator" in her garden, which proved to be a salamander, and in spring housecleaning another housewife discovered in her attic a skull resembling "a horse having a tooth sticking down its throat." Our curator of zoology prescribed the proper department in both contingencies.

Of greater importance are the tasks remaining at year's end; an article on the place of research in museums, a Museum and Science Service feature for *Museum News*; and a policy paper on the Museum's role in the Department's effort in continuing education. May we never run out of things to do.

WILLIAM N. FENTON

Assistant Commissioner for

State Museum and Science Service

Accomplishments of the Surveys

Anthropological Survey

Field Research

CONTINUING THE INVESTIGATION into the development of aboriginal settlement patterns in the Northeast, the Anthropological Survey devoted most of the 1958 field season to completion of the excavations which were begun the previous summer on the Bates site near Greene, Chenango County. This is a late Owasco period hamlet radiocarbon dated to circa A.D. 1300. With a crew of three college student assistants, five weeks were spent in clearing and manually backfilling the remainder of the site. This was the first prehistoric settlement site ever to be fully uncovered and mapped in detail in New York. It has contributed significantly to the major problem under investigation, as well as to the question of Owasco-Iroquois relationships. A 10-day reinvestigation of the Lamoka Lake site, Schuyler County, added to our knowledge of the oldest known Archaic culture in the State, and produced datable carbon samples (one already measured at circa 2500 B.C.). A site survey of the Allegheny Reservoir area between Kinzua, Pennsylvania, and the New York State line was made on a contract with the National Park Service. Site reconnaissance was carried out in the following counties of New York: Dutchess, Orange, Greene, Delaware, Onondaga, Ontario, Livingston, Albany, Essex; also in Orwell, Vermont, and near Athens, Pennsylvania. Pottery and other artifacts from Hochelaga and related sites in the St. Lawrence Valley were studied in the McCord and Redpath Museums, Montreal.

Wallace L. Chafe, The University of Buffalo, put in a third year of fieldwork on the Seneca Indian language, principally at Allegany Reservation. He extended observations on structure and collected additional vocabulary for a dictionary. He participated in the Cherokee-Iroquois symposium. At the year's end he had commenced fieldwork on the Tonawanda Reservation. His appointment as linguist at the Bureau of American Ethnology, Smithsonian Institution, reflects luster on the opportunities provided in the Science Service for professional development.

The Assistant Commissioner made some progress with personal research on Iroquois studies. He continued mapping housing on the Allegany Reservation, he assisted Edmund Wilson in fieldwork and by reading chapters for a book, he worked on a translation of Lafitau's *Moeurs des Sauvages*, and gave the Sanford Memorial Lecture at

Rensselaer Polytechnic Institute, repeating it on request at Brown University and Mount Holyoke College. He identified language texts on tapes from wax cylinders of Iroquois speeches of the 19th century for the Royal Ontario Museum. A committee of the Survey rendered a criticism of Thomas Hart Benton's sketches for the mural in the Niagara Power Authority Building. The Survey assisted graduate students at Buffalo, Columbia, Cornell, Chicago and Harvard Universities.

Laboratory Analysis

Borrowed archeological materials from several major sites were analyzed and photographed, and file accounts were made for publication. Typological studies and formal descriptions of eight projectile point types were prepared for inclusion in a major work now in preparation on the archeology of New York State.

Office Activities and Administration

The State Archeologist interviewed a total of 233 local or out-of-town visitors, including professional colleagues, students and amateur archeologists and prepared a report for the National Park Service on Allegheny Reservoir Survey. He edited two manuscripts on archeology for professional colleagues; prepared data on New York birdstones for Earl C. Townsend's book, *Birdstones of the North American Indian*, 1959, and wrote several short articles for "Notes and News," *American Antiquity*; *Teocentli*; *People's Encyclopedia* etc.

Cooperative Work

Activities under this heading include: Identified human remains for New York State Police Laboratory from seven localities in the State; typed a pottery collection from Serpent Mound site in Ontario for Richard Johnson, Royal Ontario Museum; worked with various amateurs and amateur groups in New York on sites in Sullivan, Orange, Albany and Greene Counties and other localities; prepared data for State Highway and other State Departments; assisted an R.P.I. professor with bibliography of Piltdown Man; advised National Park Service excavator at Saratoga National Battlefield, and prepared reports on four key Archaic sites in New York for National Park Service, National Site Survey.

Biological Survey

THE BIOLOGICAL SURVEY received \$7,000 from an anonymous donor for research on "punkies" (sand flies, *Culicoides* spp.) in the Adirondacks. This grant was accepted by the Regents as the Adirondack Entomology Research Fund. It enabled the employment of a full-time experienced summer assistant and the purchase of equipment such as light traps and cages. The work is expected to proceed for at least two years. The second season of work on the pollen studies was supported by the grant from the National Institutes of Health. The small mammal survey was continued from the headquarters at Richmondville. An added feature was furnishing information on the possible effects of large-scale forest spraying on small mammal populations.

Field Research by Projects

Botany Project No. 1. Aquatic plant fragments: their identification by use of anatomical characters.

Approximately 800 microscope slides were prepared, bringing the total to 1350.

Botany Project No. 2. Survey of airborne pollen grains and fungus spores.

Completed, and a final report is now in press.

Botany Project No. 3. Ragweed pollen content in the air in relation to weather conditions.

Conducted in collaboration with Brookhaven National Laboratory. A paper on a phase of this work is ready for publication.

Botany Project No. 4. Pollen spectra of bog and lake sediments.

During the previous report period sites were selected, at Lake Lamoka south of Penn Yan and at Crusoe Lake near Auburn. Both sites were visited in the summer of 1958, and samples were taken from marsh and lake sediments. Approximately 500 collections were made, and over 1,000 slides were prepared for study. The objective is to correlate floristic conditions in prehistoric times with archeological studies. In addition, the pollen from some 80 species of living plants was artificially fossilized and stored in glycerine jelly. From this material over 200 slides have been prepared.

Botany Project No 5. Tagging and sampling of ragweed pollen.

The summer of 1958 was the first full season (of a minimum of three seasons) for this project. The work is being carried on at Brookhaven National Laboratory with the aid of a grant from the National Institutes of Health. With ragweed plants grown in the greenhouse and in the field, several techniques were devised for introducing radiophosphorus which resulted in "tagged" pollen. However, the amounts taken into the pollen were very low and efforts are being made to develop means for increasing these amounts. Less success was obtained with dyes, some of them fluorescent.

The designing, building and testing of improved pollen-sampling apparatus reached the point that several models were ready for testing at the beginning of the 1959 season.

Botany Project No. 6. Checklist of the grasses of New York State.

In the course of exploring and collecting for vascular plants in general as indicated under Project No. 9, below, an attempt was made to add to our knowledge of grasses from areas visited. Approximately 125 specimens were collected, representing over 100 numbers. The work on the checklist of grasses is 97 percent completed.

Botany Project No. 7. General survey of the vascular flora of New York State.

Exploration for vascular plants was continued, special trips being made to northern, southeastern and central sections of the State and to the drainage of the Allegheny River. Two trips were made to Onondaga County with Dr. Mildred E. Faust, Department of Plant Sciences, Syracuse University, who is preparing a checklist of the plants of that county. Fieldwork was done in Ulster County, in company with Henry F. Dunbar of Kingston (who is studying the flora of Ulster County) and in southern Cattaraugus County (Professor E. H. Ketchledge, Department of Forest Botany, State College of Forestry, and Professor S. H. Eaton, Department of Biology, St. Bonaventure University). Records (either sight or those supported by specimens) were made in 27 counties. It is estimated that this project is 90 percent completed.

Botany Project No. 8. The Desmidiaceae of the Susquehanna drainage in New York State.

Dr. George Schumacher, assistant professor of biology, Harpur College, continued work on this manuscript.

Botany Project No. 9. Flora of the Allegany Reservation and vicinity.

The curator concentrated on reviewing the herbarium at St. Bonaventure University, which includes the herbarium of the Allegany School of Natural History. He also spent three days in the area collecting as indicated under Project No. 1. A manuscript has been submitted and is awaiting publication.

Entomology Project No. 1. Beech scale and Nectria (beech bark disease).

The eighth of a 10-year program of study, inspection and analysis of data from study plots established in the Catskill Mountain area was accomplished. The data will not be analyzed until next year.

Entomology Project No. 2. Gypsy moth.

Gypsy moth biological studies were carried out in the Glenville plot near Scotia in Schenectady County. Observations in the 1959 season include indications that exposure, drowning, wilt disease, parasites, *Calosoma* beetles and small mammal predation each play a primary role in the complex of environmental resistance. Gypsy moth larval behavior differed according to site conditions.

Experimental sprays against gypsy moth.

Observations in the summer of 1958 at plots in Saratoga County sprayed in the spring indicated that the insecticide Sevin was probably the most promising of the new insecticides for use against gypsy moth, and it was selected for further and more extensive trials in 1959. Final evaluations cannot be made until after egg deposit counts have been completed, but superficial observations continue to indicate the superiority of Sevin over other materials as a possible substitute for DDT where the latter is objectionable. Observations on the effects of Sevin on other fauna were also begun during the present report period. Thus far no effect has been noted on small mammals such as shrews, deer mice, squirrels and other rodents (see below).

Entomology Project No. 3. White pine weevil.

The tests of insecticides applied by knapsack-type gasoline-powered mist blower were continued. Timing is a critical factor but promise was shown in a test in which all the trees in a plot were sprayed from both sides of the rows, with a formulation of 1 percent lindane emulsion containing 1 percent Aroclor (an "extender").



Cooperative experiments with the State Conservation Department in testing new methods and new insecticides for control of the white pine weevil. Damage by the insect deforms the trees and reduces their timber value.

White pine weevil attack as related to soils in New York plantations.

Data collected in all forest districts of the State were analyzed. Tentative observations were confirmed that poor internal drainage of soil is an important factor favoring white pine weevil attack. Data from excessively drained sterile sands indicated the importance of nutrition as another factor; this suggested fertilizer studies which were begun in the spring of 1959.

Entomology Project No. 4. Plantation insect studies as related to silvicultural practices.

These studies have been completed at least temporarily, pending analysis of the data, most of which have now been compiled. Data from 51 study plots show that bark beetle attacks and buildup were least in arsenited trees where the sodium arsenite solution was applied in the summer to complete bark frills on the trunks at the base. Ax-girdling

was the least safe of the tested thinning methods because the slow dying of the trees thus treated permitted bark beetle breeding.

Entomology Project No. 5. Red-pine sawfly.

Collection of data from study plots was completed and a sequential sampling plan for predicting infestation by sampling egg-infested needles was calculated.

Entomology Project No. 6. Forest tent caterpillar.

Defoliation and dead wood data were collected in the eight sugar maple orchard study plots in the Lake George area. This completed the planned five-year period of observations.

Entomology Project No. 7. European pine shoot moth.

The Kiekens portable mist blower was used to apply sprays to plantation red pine for the control of this pest. Results will not be known until October 1959.

Entomology Project No. 8.

Twenty species of blackflies were collected in the high peak region in 1958. Two of these had never been found previously in the State.

The relationship of stream temperatures to *Simulium venustum* breeding was studied in a preliminary way.

Entomology Project No. 9.

In preliminary *Culicoides* studies, about 16 species were collected during the past three years. Biting or otherwise annoying adults collected in 1958 in the Adirondacks were identified as *C. obsoletus*, and nine species of the genus were reared. A detailed literature survey on the biology (biting habits, hosts, breeding areas, abundance, geographical distribution, taxonomy and control) of species occurring or which might occur in New York is underway.

Entomology Project No. 10.

Research activities of the curator of entomology dealt with the identification and classification of the leaf beetles, family Chrysomelidae. This work is a continuation of the projects described in more detail in the previous annual report.

Studies by the curator on the biology of the gypsy moth and other forest pests involved field observations and identification of insects. Many of the pests were identified in the State Museum; others, parasitic flies and wasps in particular, were sent to specialists.

Zoology Project No. 1. Small mammal survey.

A report was completed for publication as a Museum bulletin on the small mammal studies in Otsego and Schoharie Counties. During May, June and July 1959, a study was conducted in an area sprayed for control of the gypsy moth in an attempt to determine the effects of the insecticide on small mammals and other animals. It was planned to move the small mammal survey headquarters to the region of Tug Hill, N. Y., by August 1, 1959. As previously, an important part of the collecting program included the accumulating of ecological and biological information relating to the various species.

Two student helpers accumulated approximately 6,000 trap nights in Schoharie County, trapping in localities not previously covered. One hundred three skins with skulls, 38 skeletons and 13 skulls without skins were prepared for the collections. In March 1959, 28 live bats were collected and delivered to the Wildlife Research Laboratory in Delmar for blood testing by the Health Department in connection with the rabies investigations.

Investigations in area sprayed for control of gypsy moth. At four localities in Otsego County, within an area treated by the Federal Government with aerial applications of the new insecticide Sevin in May and June 1959, small mammal trapping was conducted and observations of other animals, especially birds, were made. No unfavorable effects of the spraying were evident; populations in general seemed unaffected, while habits and activities of the various species appeared unchanged. More work must be done, however, to determine the long-range effects of the insecticide.

Laboratory Work by Projects

A considerable amount of laboratory work was an essential part of most of the field projects, and in most instances is so closely and obviously connected with a field activity that it is not discussed separately.

The *Bird Handbook* is the major activity in the Zoology Office. There is reasonable expectation that volume 1 of the *Bird Handbook* will be ready for the printer early in the calendar year 1960. Perhaps a third of the manuscript for volume 2 is in hand.

Geological Survey

THE DIVERSE ACTIVITIES of the Geological Survey were characterized in the past year by devotion to an immediate goal and by rapid development in a new field of endeavor. An increasingly larger percentage of the time of all staff members has been directed toward meeting the self-imposed deadlines which will result in the successful completion of a new geological map. Most work in the field, laboratory and conferences by staff members has been aimed at its advance. A related project has been the compilation, by the paleontologists, of correlation charts of the major geological periods.

The new field has resulted from demands for geological data in connection with peaceful uses of the atom and in preparation for civil defense. Long-term storage of radioactive waste resulting from isotope use in industry, development of underground industrial areas and the relationship of the natural radioactivity of rock to congenital malformations pose new problems.

The year just completed has seen the filing of all vacant positions.

Field Research

Fieldwork of permanent employees in the Geological Survey was concentrated on geological mapping, both for the purposes of the State geological map and in greater detail in areas of particular interest. Investigations of mineral resources were also carried on. This work was done both by permanent staff members and by geologists temporarily employed for the summer months.

1. Bedrock geology of the Plattsburgh and Rouses Point 15-minute quadrangles.

Ten days were spent by the State Paleontologist collecting data. It is believed that all outcrops have now been visited. Unfortunately, the combination of extensive glacial cover and widespread block faulting seriously hinders the projection of formational contacts in many places. It was, therefore, decided to postpone additional work in this region pending construction of the Northway.

2. Stratigraphy and structure of Columbia County.

Some progress was made in the paleontological zoning of this complex area. The location of the heretofore unreported faunal zone above the

Elliptocephala zone (previously the only Lower Cambrian fossil zone known in Columbia County) was particularly significant. Further fieldwork is planned for the fall of 1959.

3. *Guide to the geology of the Niagara Frontier.*

All fieldwork and photography for this report have now been completed.

4. *Studies in the Helderbergian limestone.*

The staff paleontologists spent two weeks in the spring of 1958 measuring stratigraphic sections of the Lower Devonian and Upper Silurian units in the Hudson Valley. The results are to be included in a report on the stratigraphy of these rocks.

5. *Geological mapping in Orange County.*

The scientist (geology) spent a total of 83 days in the Goshen area. Mapping was concentrated on the Cambro-Ordovician dolomite and enough data were gathered to permit at least a partial subdivision of the Wappinger dolomite. Parts of the Ordovician shales and the Precambrian were also mapped.

6. *Rocks of the New York City series.*

The scientists (geology) spent approximately 12 days in fieldwork to determine the age of the metamorphic rocks of the New York City group. A known but hitherto unmapped body of Cortland complex type rock was outlined and a fault slice of Paleozoic rocks along the Precambrian border was mapped. Outcrops in the northeast corner of the Thiells 7½-minute quadrangle and the Verplanck Point area across the river were mapped.

7. *Initial studies for State geological map.*

In connection with selecting and defining map units for the new geological map, the associate scientist (geology) began spot checking and sampling unfamiliar broadly exposed rock units which have been distinguished in the main solely by geographic position (e.g., Lyon Mountain granite, Hawkeye granite etc.). He also initiated reconnaissance geological mapping in Big Moose, Old Forge and West Canada Lake quadrangles in detail sufficient for incorporation on the State map.

8. In addition to these specific field projects, numerous brief field trips were made for various purposes.

The scientist (geology) (Wellsville office) made approximately 125 well locations, 25 trips to the Northern Gas and Oil Scouts Association meeting and 50 visits to individuals and companies active in the oil and gas industry in New York State in order to gather data and familiarize them with the activities of the Wellsville office and to exchange information.

The senior scientist (paleontology) spent 25 days in the field assisting individuals working on specific problems, particularly Honorarium grantees. An unusual number of foreign paleontologists favored the State Museum with extended visits to study collections, visit classic



The study collections of the State Museum are often utilized by scientists from abroad. Dr. Michael House (center), University of Durham, England, studied Devonian ammonoids from the Museum collection.

formations and study our field methods. The following paleontologists were guided on field trips about the State or through the Museum.

Dr. Michael House, University of Durham, England (Dr. House spent about five weeks at the Museum studying the Devonian ammonoids in the collection in an effort to effect more precise correlation between the Devonian rocks of Europe and America.)

Dr. Niels Spjeldnaes, University of Oslo, Norway

Dr. Valdar Jaanusson, University of Upsala, Sweden

Professor and Mrs. Thorslund, University of Upsala, Sweden

Dr. Kenji Konishi, University of Tokyo, Japan

Dr. Wilhelm Kegel, Consulting Geologist, Rio de Janeiro

Also, Professor J. Westerveld of the University of Amsterdam was conducted on a five-day excursion of Adirondack magnetite deposits.

The first field conference on Taconic geology was held from August 11 through 15. The sponsoring organization was the Geological Survey and the groundwork for the conference was laid by the State Paleontologist. Beginning in Dutchess County, a group of geologists with a common interest in Taconic geology continued their field conference northward into Vermont. A total of 27 attended, six staying all five days.

Field Research of Temporary Personnel

1. Investigation of limestones by counties.

Work was stopped temporarily to make funds available for the State geological map.

2. Taconic geology of eastern New York.

Donald B. Potter of Hamilton College, assisted by William Harris during the summer of 1958 and Timothy Hall during the 1959 season, continued mapping the Taconic region of Washington County, completing fieldwork on the Eagle Bridge, Hoosick Falls and a portion of the North Pownal 7½-minute quadrangles.

3. Upper Devonian rocks of central and eastern New York.

The work of Dr. Robert Sutton, The University of Rochester, in mapping the Upper Devonian rocks of central and eastern New York, stands out as a record of accomplishment for recovering new geological data in an area studied. Mapping two black shales and relying on a faunal zone, Sutton has been able to trace key units from central New York into the western fringes of the Catskills.

4. *Glacial geology of western New York.*

Mapping continued under the direction of Ernest H. Muller of Cornell University. During the 1958 field season he worked in northern Cattaraugus County and southern Erie County, and during 1959 in Genesee County. The mapping west of the Genesee River will be completed before carrying it further east.

5. *Shoreline erosion of Lake George.*

At the request of the Conservation Department, Ernest H. Muller and the State Geologist spent approximately three weeks in an investigation during the 1958 field season to determine the degree of shoreline erosion of Long Island in Lake George and establish some criteria by which erosion could be measured in the future. Dr. Muller was assisted by Robert H. Dodds. Their report was duplicated by the Conservation Department.

6. *Knickerbocker Project.*

The restudy of the geology of the New York City metropolitan area was begun in the fall of 1957; it continued into fiscal 1959-60. The project is under the joint direction of Charles H. Behre, executive officer of the Department of Geology at Columbia University; J. G. Broughton, State Geologist, and Kurt E. Lowe of the College of the City of New York. Dr. Lowe is directly supervising the activities of the geological compilers who have collected a mass of information from State and municipal offices and from private engineering concerns. This information has been brought up to date by visits to open excavations. Simon Schaffel of the College of the City of New York and Rutgers University and Seymour Tilson of New York University and Columbia University were employed on the project in 1958-59.

Laboratory Work

All quadrangle size geological maps of the Adirondacks were reduced by photogrammetry to 1:125,000 scale and combined into a composite geological map using some 30 mapping units. The new base will serve for future regional, geological and mineral resources study and from it final consolidation of data will be made to the 1:250,000 scale chosen for the State geological map. Because it was decided to indicate bedrock geology on the new map slightly beyond the borders of New York State, the senior scientist (paleontology) concentrated on the geology along both sides of the Pennsylvania border.

An adjunct activity to the State map is the preparation of comprehensive correlation charts of major geological periods. The State Paleontologist completed the first of four, dealing with the Silurian rocks. A second draft of a similar chart of Devonian formations was completed.

An important addition to existing records has been the collection of a large number of gamma ray-neutron and electric logs of New York State gas wells. The new records have been made available by private companies, and they will be of particular use for subsurface correlation and structural work. The compilation of selected deep wells in areas of gas production in western New York was continued. This task is approximately 75 percent completed. Pertinent data were collected for comparative purposes on visits to the Canadian Geological Survey, Ottawa and the Quebec Geological Survey. In an attempt to reduce loss by breakage of important data all well samples stored in glass bottles and vials in the State Museum were transferred to manila envelopes. This increased the available storage space.

Three subsurface structure maps of gas fields were prepared. Approximately 35,000 feet of well cutting samples from 36 wells were collected, of which some 5,500 feet were examined under the microscope.

The State Paleontologist's contribution on tentaculids, hyolithids and other miscellaneous conical shells of unknown affinities for a treatise on invertebrate paleontology is nearing completion. The State Geologist began an investigation for the newly established Office of Atomic Development in an attempt to choose desirable sites for storage of radioactive wastes. This service involves a reinvestigation of New York salt mines and deposits and applying recent work done in glacial geology. Based partly on consultation with survey geologists, Dr. John T. Gentry of the New York State Department of Health published a paper relating the incidence of congenital malformations in the State to natural radioactivity present in certain types of rocks and glacial deposits. This report has aroused considerable lay interest. The State Geologist is supplying to the U. S. Geological Survey certain data to correlate with airborne radiometric surveys carried on in the vicinity of large reactors.

As part of a cooperative study of sources of expandable shale for light-weight aggregate, 10 shale and slate samples were collected in St. Lawrence County for kiln testing at the New York State College of Ceramics at Alfred.

Office Activities and Administration

Advice was furnished the Joint Legislative Committee on Interstate Cooperation concerning the provisions of proposed legislation dealing

with conservation of oil and gas, offshore drilling and the underground storage of petroleum products. As cochairman of the Mineral Resources Subcommittee of the New York-Vermont Interstate Committee on the Champlain Basin, the State Geologist prepared a report on the mineral resources for the September meeting held at Vergennes, Vermont. He also approved a number of oil and gas leases which were negotiated by the State Conservation Department.

The annual contract between the United States Bureau of Mines and the Geological Survey concerning collection of mineral production statistics was consummated.

The staff of the Geological Survey carried on extensive correspondence with private individuals and concerns on the identification of fossils, minerals, rocks and ores; and relative to maps and oil and gas wells.

The annual geological Newsletter was compiled by all staff members.

The Museum

General

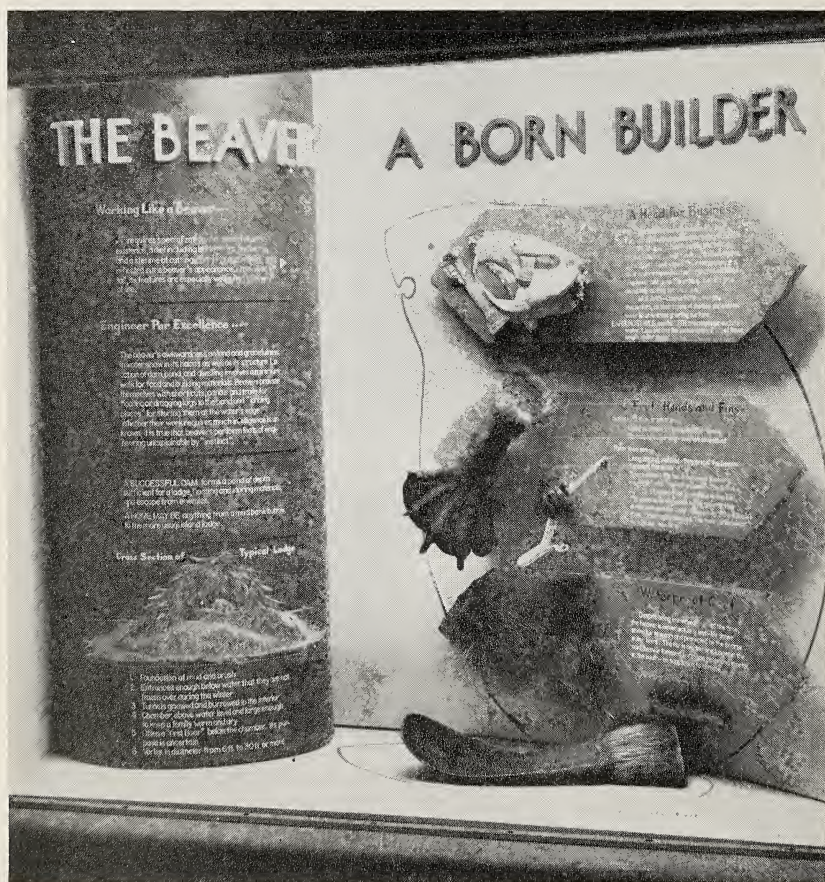
CONSIDERING THE SIZE OF THE STAFF (five full-time employees supplemented by two part-time assistants), a relatively large amount of renovation, new construction and temporary or special exhibit work was accomplished. All persons involved exerted strenuous efforts to advance the program.

Two major projects were initiated this year. The more important of these was the first stage of the renovation of Paleontology Hall. Based on an imaginative design by the exhibits designer, a flowing wall or partition was erected from the entrance to a point about halfway to the southeast corner of the hall. This wall, which is topped by a canopy, will contain the "windows" through which the exhibits will be viewed. The section of the project initiated in 1958-59 was approximately one-third finished at the close of the year. It represents a little more than one-quarter of the entire job for the hall. However, it is hoped that the project will be completed by the end of the calendar year 1964.

Construction of the wing to the Education Building forced the evacuation of the herbarium from its quarters at the Hawk Street end of the Museum offices. Nearly a year earlier than anticipated, it was necessary to move some one hundred storage cabinets and other equipment to the planned area in the northwestern portion of Biology Hall. To clear the floor area, most of the movable exhibits were rearranged and two fixed displays were dismantled. Due to age and attrition, little material of value was removed from public view and much of the compression was effected by the removal of semiempty cases. The displays, particularly in the fields of fishes, birds and mammals, will be rehabilitated and restored to view in modernized and beautified settings. It is hoped that the final result of the project will be more attractive and instructive exhibits. While a research facility was gained and better working conditions were achieved in the herbarium, the program of modernization, however, especially in Paleontology Hall, has been set back materially. Another loss is the material reduction of floorspace available for future exhibits in the important area of plant and animal life. This reduced space will not be sufficient for biological displays which will be in numerical or spacial balance with those in paleontology and geology. The construction of a modernized Hall of Biology, how-

ever, cannot be initiated for many years unless the modernization program is accelerated to an unforeseen degree.

The skill and cooperative efforts of the designer and senior museum technician and their assistants and the technical advice of the curators and scientists were responsible for completing the assembly of an excellent habitat group, "Life at a Beaver Pond," an exhibit on the earth and its structure, a tribute to the famous paleontologist, James Hall, and numerous other fine pieces of work. As usual, a great amount of time and skill went into patching and repairing old, dilapidated casts, mounts and other objects. Much of this work, while necessary, should be turned over to less experienced hands, thus making available more time of our



This accessory display to the beaver habitat group features the major anatomical adaptations of the beaver as well as a diagram of a typical lodge.

skilled craftsmen to turn out new and intricate displays for the modernization program. Several special, temporary exhibits also were constructed. While these shows were essential and worthwhile, they also diverted the staff from the main job.

A marked rise in public attendance is encouraging. Based on the same statistical method of estimating from once-weekly tallies, attendance has increased from 112,000 in 1956-57 to 140,000 in 1957-58 to 175,000 in 1958-59. It is evident that many persons are aware of and interested in the program of renovation and modernization. This enhanced interest, however, has not been reflected in the cooperative educational program for the benefit of the schools. The number of children who visited the Museum in organized groups was 29,700 in 1958-59 as compared with 28,200 two years previously. The number in guided tours (led by Museum education staff members) was 14,500, a very slight increase over the 14,000 in 1956-57 and a decrease from the 16,300 of 1957-58. Some of the decline of the past year is attributable to the fact that the Museum education staff was reduced early in the period from three persons to two as a result of the supervisor's resignation. This made it impossible at times to accommodate all requests for guided tours of the exhibit halls.

As always, a great amount of work was accomplished by the curators. While much of it may be summarized as routine care and increase of the collections, the work is essential to the functioning of the State Museum and Science Service. Accessions were made to all sections of the collections, particularly in the herbarium. Many requests for information were received from the public and from offices of the State and local government and were answered as completely as possible. The curators gave excellent cooperation to the Museum education program by guiding school and college groups through the exhibit halls. Most members of the curatorial staff accomplished some research during the year despite the pressure of other duties and a dearth of assistance. The most notable progress in research, probably, was in the field of entomology.

With only one exception, all manuscripts accepted during the year for publication had been edited and sent to the printer by the close of the period. (The exception was turned in only a week or two previously.) While the output of the previous year was much greater than in 1958-59, this was due to an accumulation of manuscripts which had been building up over several years and were finally printed. The production of technical papers undoubtedly will increase again in 1959-60.

It is encouraging that many members of the staff were able to attend meetings of technical and professional societies. This enabled

our people to keep in touch with others who are doing similar work and to keep their programs flexible by adopting new ideas and procedures. The Assistant Director also made studies of exhibits at the American Museum of Natural History in New York, the Smithsonian Institution in Washington, the Museums of Natural History, Art and Health in Cleveland, Ohio, and at the Academy of Natural Sciences, the University of Pennsylvania Museum, the Museum of Wistar Institute and the Museum of Art in Philadelphia.

A series of chamber music concerts was given in Orientation Hall on Sunday afternoons in July and on October 13 (Columbus Day observance) and November 11 (Veterans' Day). In cooperation with the Albany chapter of the American Federation of Musicians, the series featured the String Ensemble with T. Roy Kiefer, director, the Traldy String Quartet, Edward A. Rice String Quartet and Fred Graziade String Quartet. While attendance at some of the concerts was small, the audiences were highly appreciative of the quality of the music and the introduction of a new cultural feature in the Museum.

In cooperation with the Science Teachers Association of New York State, Inc., the State Museum put into effect a plan for giving recognition to Regional Science Congress contestants and winners. Exhibition space in Orientation Hall is provided for outstanding individual exhibits, not based on presentation, for grades 7 through 12, for periods of four months during each year beginning July 1, 1959, for each of the Regional Science Congress districts. Judging for eligibility in this program is done by the Science Teachers Association.

Charges for transportation of the exhibits are provided, plus living expenses in Albany for a period of 24 hours, for each winning student at the time that his exhibit is to be opened to view in the State Museum. This enables the winners to assist in setting up their exhibits, to tour the Museum exhibit halls, to consult with science curriculum and other officials of the Education Department, and to become acquainted with the work of the State Museum and Science Service. These students are welcomed in the offices and laboratories to meet and talk with members of the staff in fields of their interest and to watch work as it proceeds on permanent Museum exhibits.

The first of the winning students, Michael Wolfberg of Clarence, was received at the Museum in June 1959. He was congratulated by Commissioner Allen, Deputy Commissioner Nyquist and other officials of the Education Department, who encouraged him to proceed in his chosen field of science (mathematics). His exhibit, an electrical version of the game of Tac-Tix proved to be popular with the public. It



Michael Wolfberg, of Clarence, the first Regional Science Congress winner, demonstrating his exhibit, an electronic version of Tac-Tix.

is hoped that this program will help to promote an increased interest in science among the young people of New York State.

If the State Museum is to provide adequate service to the public, several requirements must be supplied. Aides must be provided for the curators to relieve these highly trained employees of the more menial but necessary portions of their duties and thus make more time available

for the technical aspects of curating. Storage equipment is needed to house safely the valuable collections of minerals, fossils, plants, animals and archeological material which are among the most important reference standards of science. In order to speed the renovation program in the exhibit halls, more workers and funds for materials and contract projects are essential. Adequate ventilation must be provided for the comfort and health of visitors. The skylights which admit an uncertain light to Geology and Paleontology Halls should be replaced by a solid roof which will not leak and will permit the use of uniform, modern lighting for the exhibits. Finally, an enlarged program of education for the school children of the State should be instituted through employment of a larger, well-trained staff using all the techniques of modern museum pedagogy, exhibits and equipment.

Curatorial Activities

Archeology

The curator answered the requests of at least 113 visitors. These answers included the identification of bone specimens for the New York State Police B.C.I.; counsel to high school students on the requirements for a career in archeology; advice to amateur archeologists on the excavation of sites and the preservation and recording of excavated material; opening the collections to visiting scientists for study, and making many identifications of items, both cultural and nonartifactual, brought in by the general public. Other similar inquiries were answered by mail. Advice was given to the building committee of the proposed Mattatuck Library-Museum, on the needs in space and facilities for a small archeological museum.

On request, advice was given to Thomas Hart Benton for a mural for the Niagara Power Authority Building at Niagara Falls in the form of photographs of typical articles of Iroquoian material culture from the Museum collections.

During February and March, the services of Andrew Pohl were employed in restoring pots from the Bates site. During April, May and June the temporary services of Mrs. Floyd Hill were utilized in the repair of the Iroquois National Wampum Belts, which were attached to a linen backing to prevent further parting of the fabric and loss of beads.

The project of dismantling the older exhibits swung into high gear when Morgan Hall was repainted. The process of checking against the catalog the artifacts removed from exhibit is continuing and the reorganization of the study collections is progressing.

A card was designed for recording information of value to the New York State Museum of material in other museums and private collections. Thirty-four slides were bound and added to the collection.

Several guided tours of the Indian Groups were given by the curator, in cooperation with the Education Office.

For the Archeology Office, a filecard was designed by the curator for the mounting of prints and recording pertinent information concerning the subject shown. Requests for negatives from the unified files continued to require the services of the curator.

He advised the museum librarian on the compilation of a bibliography on Indians and contributed the text for a popular guide to the groups of Iroquois Indian life.

Botany

Activities of the curator resulted in the following collections:

Fungi	1,553
Algae	17
Mosses and liverworts.....	1,146
Vascular plants	1,107
	3,823

The curator also donated 7 specimens of *Crataegus* collected prior to 1947 in Chemung County. Dr. William C. Denison, temporary expert in 1957, sent 248 specimens of fungi from Cattaraugus County. Anton R. Slysh, recipient of Graduate Student Honoraria in 1957 and 1958, forwarded 280 specimens of *Peniophora*. There were two notable gifts. Henry F. Dunbar, Kingston, who is making a study of the flora of Ulster County, donated over 1,000 mounted specimens. Dr. Frederick J. Hermann, Beltsville, Md., sent a series of 200 packets of Bryophytes, all named either by himself or other experts in the field. Several other individuals or institutions donated specimens or sent them in exchange. A summary of these donations follows:

	New York State	Elsewhere	Total
Fungi	2,403	78	2,481
Algae	17	..	17
Mosses and liverworts	1,456	37	1,493
Vascular plants	2,231	116	2,347
	6,107	231	6,338

Due to moving the herbarium, many of the specimens have not been verified or identified; consequently, many records have not been transcribed. From those recorded, however, have resulted the following

numbers of additions of species or subspecies to our records of vascular plants for the counties noted:

Albany	2	Essex	3	Onondaga	1
Cattaraugus	18	Greene	1	Putnam	31
Chautauqua	2	Herkimer	1	Seneca	1
Clinton	1	Jefferson	1	Suffolk	3
Delaware	3	Kings	16	Ulster	6
Erie	1				

Two taxa of vascular plants were added to the records for New York State, both sent by Roy Latham of Orient: *Carex acutiformis* and *Glyceria maxima* subsp. *maxima* are European weeds, which are rarely found on this continent. Dr. Frederick J. Hermann of Beltsville, Md., collected a number of interesting mosses, many of which are new to some districts of the checklist. These, including *Oncophorus tenellus* and *Rhacomitrium canescens* which are new to the State, are being reported by him. Dr. Clark T. Rogerson of the New York Botanical Garden accompanied the curator on many collecting trips and identified many of the fungi. Four of these species are apparently new to the State.

The herbarium was moved to the north wing of the fifth floor of the Education Building. By the close of the year all cases were in place and the out-of-State materials were interpolated with the in-State genera. These new quarters allow us to have all the collections relatively close together on one floor, adjacent to research laboratories in the wing. It also provides a large workspace for the curator, a smaller one for an assistant and an alcove where visiting botanists may work undisturbed. Sorting tables, plumbing and lights will be installed in the near future.

Entomology

The transfer and rearrangement of the collection of exotic beetles was completed. Similar work on a portion of the exotic moths was curtailed for lack of storage drawers.

Many insect specimens were collected by the curator and scientists of the Biological Survey. Of these, only a few related to special projects have been mounted and placed in the study collections. Most will be stored dry, or in alcohol until an assistant is available to mount and label them.

Cooperative work with the Forest Pest Bureau, Conservation Department, called for identification of forest insect pests. Considerable effort was made to build up a reference collection of these insects. John Flynn of the University of North Carolina spent June 5, 1959, in the Museum studying the type collection of Homoptera.

Approximately 360 requests for information called for identification of a particular insect and the means of controlling it should it become a pest.

Geology

Six hundred sixty specimens from the systematic mineral collection of New York State were cataloged. The curator of geology was assisted in this work through the part-time help of two assistants, Clayton La Valle and Harvey Korotkin. Material from approximately five cases in the physical and economic geology section of the Museum was sorted and either stored or discarded in an effort to expand and rearrange storage space.

Approximately 31 sets of New York State rocks and minerals were donated to schools for classroom study purposes. After a loan policy was adopted about the middle of the year, 25 boxed collections were sent to 16 New York State schools and 9 to schools in other States.

Data are being collected for a revision of *New York State Museum Bulletin 70, List of New York Mineral Localities*, 1903. D. E. Jensen, head of the geological division, Ward's Natural Science Establishment, Inc., will collaborate with the curator.

During the year seven talks and tours of the geological exhibits were given to school and college groups.

Various rock, mineral and ore specimens were identified for office visitors. Ten of the specimens were identified through use of the X-ray diffraction equipment of the State Police Bureau of Criminal Investigation.

Public requests for information are listed below. The heading indicates the subject about which information was requested; the number which follows is the number of requests received and answered for that particular subject:

Form letter requesting the writer's teacher to apply for a loan of representative New York State rocks and minerals	173
New York State geological information	106
New York State mineralogical information, i.e., gems and precious stones, mineral localities etc.	62
Soil samples requested (forwarded to Department of Agriculture, Cornell University, Ithaca)	20
Museum information	8
Miscellaneous, i.e., caves, books, photographs, careers etc.	46
Total	415

Paleontology

Type numbers were changed from the fractional number system to serial numbers on 336 type specimens which had been on exhibit. The contents (771 type specimens and 5,333 nontype specimens) were removed from a number of Museum exhibit cases and the material was cataloged and stored. Thirteen new specimens were added to the type collection and cards for the same were entered in the catalog. Collections containing approximately 376 specimens were packed for shipment. Seventy-eight accession entries were made in the locality and accession records and 152 specimens were ticketed with locality numbers. As usual, a considerable amount of time was spent in keeping the type catalog up-to-date.

Approximately 140 fossil type specimens were identified for some 50 visitors to the office. Harcourt, Brace & Co. of New York City was supplied with six photographs of groups and restorations on exhibit in the Museum. Among professional visitors and their interests were Francis Hueber and James O. Gierson of Cornell University (fossil plants), William B. N. Berry of Peabody Museum, Yale University (graptolites), and George Theokritoff of the Museum of Comparative Zoology, Harvard University (trilobites).

Zoology

Field trips were made with local bird clubs helping gather data on migration and distribution of birds in New York State. These trips were generally made on weekends. Work was done on map files of distribution of animals in New York State with particular reference to birds and reptiles and amphibians. Several more species were mapped for the *Bird Handbook* and earlier maps to be published in volume 1 were checked and revised.

The usual correspondence, consultation and advisory work with scientific organizations and other State agencies were handled. The Radio Division of the Commerce Department was again helped in preparing radio scripts on the animals of the State.

The catalog shows 19,011 entries, 670 being entered during this period. The majority of these entries are from the Small Mammal Survey.

The curator of zoology gave special guided tours in Biology Hall to five groups. He also lectured widely in nearby schools.

The curator is putting the finishing touches to the series of bird distribution maps for the *Bird Handbook*. Information is being gathered and cataloged for a more permanent Checklist of New York State Birds.

Accessions

During 1958-59, generous donors contributed many hundreds of objects, natural history specimens and other material to the collections and exhibits of the State Museum. (One purchase is specified.)

Archeology

Fiberglas cast of Iroquois mask	David Bartholomew, Hudson, N. Y.
Buffalo robe	Mrs. James Hill Estate, Albany, N. Y.
Skeletal material from two burials	R. Arthur Johnson, Latham, N. Y.
Indian grooved ax	R. E. Kleinstaubert, Suffern, N. Y.
Collection of flint samples from Ohio	C. Lucy, Athens, Pa.
Gourd rattle of Seneca Medicine Society	K. Mynter, Claverack, N. Y.
Indian artifacts	Rev. C. Plumb, Salem, N. Y.
Collection of flint from Ireland and Ohio	A. G. Smith, Norwalk, Ohio
Archeological collection of Brick C. Smith	Daisy Smith, South Dayton, N. Y.
Iroquois woman's costume (purchased)	Mrs. Rose Spring, Tonawanda Indian Reservation
Fragments of the "Oneida Stone"	A. G. Zeller, Oneida, N. Y.

Botany

Grasses from New York State (8)	New York Botanical Garden, New York, N. Y.
Vascular plants from North America (17)	U. S. National Herbarium, Washington, D. C.
Lichens (38)	University of Colorado, Boulder, Colo.
Mosses from North America and Sweden (35)	University of Colorado, Boulder, Colo.
<i>Climacium</i> (1)	University of Colorado, Boulder, Colo.
Vascular plants from New York State (4)	Theodore Baim, Schenectady, N. Y.
Lichens from New York State (Madison County) (19)	Irving M. Brodo, Ithaca, N. Y.
<i>Picca glauca</i> from New York State (3)	David Cook, N. Y. State Conservation Dept., Albany, N. Y.
Fungi from Cattaraugus County, N. Y. (248)	Dr. William C. Denison, Swarthmore College, Swarthmore, Pa.
Vascular plants from Ulster County, N. Y. (1091)	Henry F. Dunbar, Kingston, N. Y.
Bryophytes from New York State (200)	Dr. Frederick J. Hermann, Beltsville, Md.
Two taxa of vascular plants	Roy Latham, Orient, N. Y.
Mosses (32)	Roy Latham, Orient, N. Y.

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| Flowering plants from Suffolk County, N. Y. (39) | Roy Latham, Orient, N. Y. |
| <i>Gloeotulasnella caluspora</i> from Madison County, N. Y. (1) | Dr. Josiah L. Lowe, Syracuse, N. Y. |
| Fungi (3) | Dr. Orra A. Phelps, Wilton, N. Y. |
| Bryophytes (79) | Dr. Orra A. Phelps, Wilton, N. Y. |
| Vascular Plants of New York State (50) | Dr. Orra A. Phelps, Wilton, N. Y. |
| <i>Peniophora</i> (200) | Anton Slysh, Syracuse, N. Y. |
| <i>Hyndellum</i> from Warren County, N. Y. (1) | Anton Slysh, Syracuse, N. Y. |
| Vascular plants from New York (16) | Ralph Smith, N. Y. State Conservation Dept., Albany, N. Y. |

Geology

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| Petalite collected at Varutrask, Sweden (1) | Herbert J. Arnold, Otis, Mass. |
| Minerals (many of them quartz crystals) collected at Ellenville, N. Y. (bequest) (614) | P. Edwin Clarke Estate, Ellenville, N. Y. |
| Cinnabar with calcite and chalcedony (1) | Harold Frick, Petaluma, Calif. |
| Euhedral quartz crystals with chlorite inclusions (3) | William H. Hallenbeck, Kinderhook, N. Y. |
| Serpentine and chrysotile collected at Thurman, N. Y. (10) | Elmer Rowley, Glens Falls, N. Y. |
| Ruby spinel and graphite in calcite from Newton, N. J. (1) | Arthur Welling, Warwick, N. Y. |
| Mica and fluorite in massive chondrodite from Pine Island, N. Y. (2) | Arthur Welling, Warwick, N. Y. |
| Crystalline beryl with quartz and muscovite from Media, Pa. (3) | Arthur Welling, Warwick, N. Y. |

Paleontology

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| Slabs bearing parts of trilobites from Onondaga limestone, Williamsville, N. Y. (3) | Buffalo Society of Natural Sciences, Buffalo, N. Y. |
| Graptolites from Columbia County, N. Y. (23) | W. B. N. Berry, Peabody Museum, Yale University, New Haven, Conn. |
| Fossil pteropods from Marcellus horizon near Hayter Gap, Va. (3) | Dr. Michael House, University of Durham, England |
| Fossil plant from the Carboniferous of Pennsylvania (1) | Edward Smith, Utica, N. Y. |
| Fossils from various formations and localities on the Rhinebeck, Poughkeepsie, N. Y. (30) | A. Scott Warthin, Poughkeepsie, N. Y. |
| Fossils from various formations and localities on the Cooperstown, Hartwick and Richfield Springs quadrangles, N. Y. (36) | D. H. Zenger, Dartmouth College, Hanover, N. H. |

Zoology

Bird specimens (including a varied thrush, fourth specimen on record for the State)	John Belknap, Gouverneur, N. Y.
Bird specimens	Mrs. Donald Radke, East Chatham, N. Y.
Glass case of birds mounted by Dr. Emil Miller around 1900	G. Sann & Family, Rensselaer, N. Y.
Bird specimens (including a Bicknell's thrush, first from Peekamoose Mountain during breeding season)	Daniel Smiley, Lake Mohonk, N. Y.
Crickets (2)	Daniel Smiley, Lake Mohonk, N. Y.
Bird specimens	Mrs. Myra Smilow, Red Rock, N. Y.
Stuffed skin of a native Long Island rattlesnake	Southside Sportsman's Club, Oakdale, Long Island, N. Y.

Loans

Materials in the collections of the State Museum were loaned as follows:

Archeology

Splint basket, wooden mask, rattles (2)	Dr. Jean Boek, Albany, N. Y.
Indian artifacts and beads (10)	Carle Place High School, Carle Place, N. Y.
Iron trader's ax, pipe and tomahawk	New York State Department of Commerce, Albany, N. Y.
Indian artifacts (15)	Rensselaer County Junior Museum, Troy, N. Y.
Typical prehistoric Indian potsherds (24)	University of Michigan, Ann Arbor, Mich.
Orient-type projectile points (19)	University of Oklahoma, Norman, Okla.
Indian artifacts and beads (10)	Roland Lindale (Boy Scouts) Ravena, N. Y.

Botany

Type specimens of fungi (4)	Canadian Department of Agriculture, Ottawa, Canada
Type specimens of fungi (2)	Harvard University, Cambridge, Mass.
Type specimen of fungi	State University of Iowa, Iowa City, Iowa
Type specimens of fungi (26)	University of Massachusetts, Amherst, Mass.
Type specimens of fungi (111)	University of Tennessee, Knoxville, Tenn.
Type specimen of fungi	University of Wisconsin, Milwaukee, Wis.

Entomology

<i>Oberea</i> (long-horned wood-boring beetles) (70)	Stanton D. Hicks, Ottawa, Canada
Drawer exhibits of tree pests (4)	Francis Larmore, Schenectady, N. Y.
Drawer exhibits of insect pests (4)	Edward Morrison, Saranac Lake, N. Y.
Gypsy moth parasites, Diptera (95)	Dr. H. J. Reinhard, College Station, Texas
Drawer exhibits (general insect collection) (3)	Saddlewood Elementary School, Colonie, N. Y.
Schmidt box with 9 insects	Harry V. Scott, Schenectady, N. Y.

Geology

Boxed collections of N. Y. State rocks and minerals (25)	Schools in New York State (16) and out-of-State (9)
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Paleontology

Graptolites (114)	William B. N. Berry, Peabody Museum, Yale University, New Haven, Conn.
Fossil brachiopods (12)	Dr. G. Arthur Cooper, U. S. National Museum, Washington, D. C.
Type specimens of fossil brachiopods (4)	J. A. Fagerstrom, Ann Arbor, Mich.
Fossil cephalopods (7)	Dr. R. H. Flower, Socorro, N. Mex.
Fossil specimens (26)	Herricks Junior High School, Long Island, N. Y.
Type specimen of a supposed fossil barnacle	Dr. Harry S. Ladd, Washington, D. C.
Fossil specimens (29)	Manetuck School, Long Island, N. Y.
Brachiopod type specimens (4)	Mrs. Helen McCammon, Bloomington, Ind.
Fossil specimens (29)	Phelps Lane School, Long Island, N. Y.
Type specimens of fossil bryozoans (2)	Mrs. June Phillips, New Haven, Conn.
Fossil specimens (65)	J. F. Pickett, Averill Park, N. Y.
Specimens of fossil brachiopods (7)	Dr. Paul Sartenaer, Ottawa, Canada
Type specimens of fossil sponges (2)	D. B. Sass, Cincinnati, Ohio
Type specimens of trilobites (14)	Dr. Erwin C. Stumm, Ann Arbor, Mich.
Fossil cephalopods (5)	Dr. Curt Teichert, Denver, Colo.
Trilobites (3)	George Theokritoff, Cambridge, Mass.
Type specimens of trilobites (20)	H. B. Whittington, Cambridge, Mass.
Fossil specimens (29)	Woods Road School, Long Island, N. Y.

Zoology

Bird study skins (2 loans)	Department of Conservation, Cornell University, Ithaca, N. Y.
Mounted birds	Niskayuna Elementary School, Niskayuna, N. Y.
Bird study skins	Mrs. George T. Parker, East Greenbush, N. Y.
Mammals	Queens College, Flushing, N. Y.
Mounted birds and mammals	Rensselaer County Junior Museum, Troy, N. Y.

Donations

Specimens and other material which were duplicated in the collections were given outright to schools, cooperating institutions and individuals.

Geology

Sterlingbush calcite crystal	Reading Public Museum, Reading, Pa.
Samples of Black River sands of New York State (16)	Pan American Petroleum Corp., Tulsa, Okla.
Collections of New York State rocks and minerals (31)	Schools, for classroom study
Ellenville quartz crystals (16)	Geology Department, Leland Stanford University, Palo Alto, Calif.
Mineral specimens, anorthosite, principally (15)	Students, for Science Fair Exhibits

Paleontology

Fossil specimens, duplicate (23)	Canastota Central School, Canastota, N. Y.
Fossil specimens, duplicate (22)	Cherry Lane School, Long Island, N. Y.
Duplicate specimens (5)	Massachusetts Institute of Technology, Cambridge, Mass.
Specimen containing eurypterid fragments	Museum of Comparative Zoology, Cambridge, Mass.
Rubber casts of type specimens of brachiopods (6)	National Museum of Victoria, Melbourne, Australia
Fossil specimens, duplicate (41)	Norwich University, Northfield, Vt.
Photographs of a type specimen of brachiopods (2)	Dr. Paul Sartenaer, Ottawa, Canada
Fossil specimens, duplicate (22)	Sidney Central School, Sidney, N. Y.

Exchanges**Paleontology**

Trilobites from the Onondaga limestone (3)	Buffalo Society of Natural Sciences, Buffalo, N. Y.
Slab of starfish from Mt. Marion beds, Saugerties, N. Y.	U. S. National Museum, Washington, D. C.

Museum Exhibits

Two major projects were commenced this year. The most significant job was initiation of a complete renovation of Paleontology Hall.

A scale model was constructed to show architectural design and color of the new interior walls, the arrangement of cases and the storage area behind exhibits. A close estimate was made of the required storage space and was included in the overall plan of the hall. The specifications and model were the result of numerous consultations between the Exhibits Designer and the State Paleontologist to develop the systematic arrangement and dimensions of the 62 individual exhibits. It is gratifying that study of the model by a number of Department architects and others resulted in uniformly favorable comments and no suggestions for major changes in color or design. The Exhibits Designer drew up detailed plans to permit work to begin in the southeast quarter of the hall. After the full-scale layout was made, jigs were devised to cut the sweeping curves. Serious delays in procuring building material made it necessary to improvise and patch together numerous members of the framework. By the end of the year the skeleton of the wall was completed, from the entrance to and including the end of the first alcove, and the canopy for the latter was installed. Considerable time was required to make the display case around the supporting column at this alcove and to move, cut and reassemble the base slab of fossil glass sponges. Estimates were completed for construction material, finishes, spotlights and hardware for the next two years.

The first exhibit for the new Hall of Ancient Life, a memorial to the famous paleontologist, James Hall, was virtually completed. Some progress was made on the design of individual exhibits; a scale model for the geologic time clock was finished and photographs were made in the field for an exhibit which will explain the work of the paleontologist. Basic ideas for the remainder of the 12 displays in this quarter of the hall were worked out in collaboration with the scientific staff. However, the program for design and construction of the hall was severely curtailed due to emergency work in Biology Hall. Time was also allotted to building several special and temporary exhibits as well as for routine maintenance and repairs.

Early in the spring of 1959, progress on the wing of the Education Building virtually cut off access of the Botany offices to light and air. It was decided to put into effect the reestablishment of the herbarium in Biology Hall which had been tentatively planned for the following winter. Despite the generous cooperation of the Department in

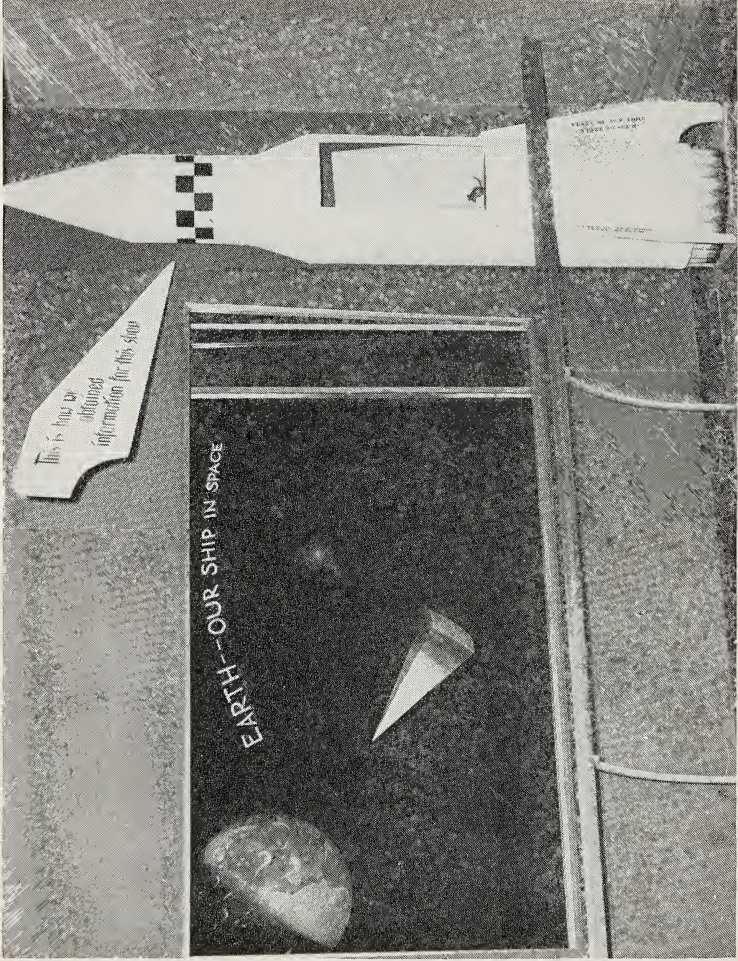
furnishing temporary help for shifting exhibits and moving the herbarium cabinets and other equipment, it was necessary to divert the Museum maintenance personnel to supervise and assist in this work. A new floor plan was worked out for Biology Hall to clear a rectangle approximately 40 x 70 feet in the northwestern part of the area. Several old displays, including the bison exhibit, were dismantled and the specimens were stored. Cases and walls were rearranged and remodeled so that, with the addition of two doors, the public was limited to the remaining exhibit space. Approximately 50 tons of equipment was moved from the Botany offices in the Hawk Street wing of the building, up one flight and into the new location in Biology Hall. There it was rearranged according to plans drawn by the curator. At the end of the year the actual shifting of cases and herbarium cabinets had been completed, but plumbing and lighting in the herbarium was yet to be installed. In the newly arranged exhibit area a great number of old specimens were to be renovated and replaced on display in new settings, and considerable new wiring was to be furnished to permit the use of fluorescent lighting for the exhibits.

Several permanent exhibits were finished during the past year. The beaver habitat group and its flanking displays were installed. The small exhibits illustrate some of the major anatomical adaptations of the beaver as well as a diagram of a beaver lodge and paintings showing the ecological effects of beaver dams. The entire display, entitled "Life at a Beaver Pond," depicts the typical ecological area which is utilized by the beaver and many other such animals and plants which are characteristic of the community.

An insect display near the Beaver Group was renovated with the assistance of the curator of entomology, who also prepared five exhibits which can be lent to schools or used in Biology Hall. A new exhibit on poisonous plants, including specimens by the senior museum technician and plant sketches by Theodore Baim of Schenectady was assembled.

Eight new reproductions of Iroquois masks from the collections were installed overhead in the False Face Ceremonial Group. This illustrates some of the mask types, and frees the originals in storage for study. The newest display in Morgan Hall is that of Indian food plants. These 80 replicas include native species as well as European plants introduced by the colonists. The exhibit was enlarged during the year by addition of several specimens. Only two plants remain to be copied to complete the display.

The first permanent exhibit in Orientation Hall, "Earth—Our Ship in Space," was installed and opened to the public in January 1959. The



The first permanent exhibit in Orientation Hall presents the Earth, its strata and its relationship to space.

display shows the planet as it might appear from about 30,000 miles in space. The model of the earth, painted in fluorescent colors by Thomas W. Voter, director of the Hudson River Museum at Yonkers, is illuminated by "black light." The earth model glows against a dull black background, dotted with luminous stars, which represents the darkness of outer space. A plug projects from the model to show in section the strata of the earth from the surface to the center. At the side of the case is a colored column illustrating the layers of the earth's atmosphere. The exhibit was constructed according to the advice of various scientists, among them Drs. Vincent Schaefer of the Munitap Foundation, Curtis Hemenway of the Dudley Planetarium, and missile expert Wernher Von Braun of the U. S. Army Missile Center.

Three temporary exhibits were assembled in Orientation Hall. The State Botanist and other members of the State Science Service contributed information for the exhibit on "Pollen as a Research Tool." A Seneca woman's costume, purchased from Mrs. Rose Spring, is displayed draped on a mannequin to illustrate the current feminine ceremonial fashions on New York reservations. The curator of archeology arranged various Iroquois wampum belts to show intertribal council relationships within the League of the Iroquois.

Repairs and renovations in the Museum halls included the semiannual cleansing of the New York State relief map, restoration of a crumbling magnesium ingot and renovation and rearrangement of the bird exhibits, including the mounts of domestic poultry. Revisions were made in the Myron H. Clark Hall of Indian Groups, where the interiors of the groups were cleaned, the lighting revised and inflammable material readjusted to reduce fire hazard. Diagrammatic labels were painted on the sills and the first section of new aluminum railing was installed.

Numerous exhibits were planned or partially completed. A permanent exhibit for Orientation Hall, "How Geology Determines the Topography of New York State," is in an early construction stage. Two new Devonian dioramas, featuring fossil glass sponges and eurypterids, were virtually completed at the end of the year.

Special shows during the year included: a display of Iroquois False Faces and copies by David Bartholomew of Hudson, N. Y.; paintings of grasses by Marguerite Scott, Naples, N. Y.; "Animal Portraits," a group of photographs by Walter J. Schoonmaker, former exhibits planner at the State Museum. A special show combining examples of the handicrafts of the Shakers and the Iroquois Indians was in preparation at the close of the year.

The Public

Once-weekly counts of visitors to the exhibit halls were made on 53 days. The totals on individual weekdays ranged from a low of 214 (July 23, 1958) to a maximum of 1,035 (March 19, 1959). Excluding Saturdays, Sundays and holidays (when the highest attendance, 1,478 visitors, was recorded on Veterans' Day), the daily average was 550 persons or a total for the year of 177,600. This a material increase over the two previous years (140,000 in 1957-58 and 112,000 in 1956-57) during which the same method of estimating on once-weekly counts has been employed.

The Department nurse was called to attend a total of six visitors who required some medical assistance. One woman suffered a fall in the Hall of Indian Life Groups and another fainted in the same area. Of the remaining four instances, involving children who had attacks of fainting, one occurred in Biology Hall and three among the Indian Groups. The concentration of cases of illness emphasizes the fact that this portion of the Museum is poorly ventilated. The best efforts to ameliorate conditions by reducing overheating during the colder months and by placing fans at strategic locations have not solved the problem. Means should be found for bringing fresh air in adequate quantity into the exhibit halls.

The Museum guards have continued to carry out their duties faithfully and efficiently and have performed numerous helpful services beyond the strict confines of their job descriptions. Numerous minor repairs have been made voluntarily, glass has been washed, cases moved and painted, and assistance has been rendered on many occasions to the Museum maintenance and exhibits personnel and to other sections of the staff. Thanks largely to vigilance of the guards, disturbance to visitors and vandalism on exhibits, furniture and the building continued nominal. Valuable assistance in dealing with many of these problems has continued to come from the Building Superintendent's office.

Special Services

Program for Educational Groups

THE MUSEUM EDUCATION OFFICE has carried out the policy of providing visiting classes with guided tours which supplement schoolwork. During the tours the children have the opportunity to examine pertinent objects from the Museum collections. The tours are adapted by the instructors to the requirements of each group. Children are encouraged to ask questions and to participate in the discussions.

Because of two factors, the number of guided tours declined during the 1958-59 year. The limited education staff was unable to accommodate all those who requested guided tours. In the fall, when Indian tours are most popular, sections of the Indian Groups were closed for painting. The Museum Education staff was assisted in giving tours during the year by the senior museum technician (1) and the curators of archeology (11), geology (4) and zoology (7).

Problems include poor ventilation, unlighted exhibits and a limited Education staff. Lack of luncheon facilities for visiting classes creates difficulties for those groups which plan to spend the day in Albany.

Educational Group Instruction

Attendance of organized educational groups at the Museum rose from 25,190 in 1957-58 to 29,678 in 1958-59 (a 15 percent increase). The number of students receiving guided tours declined from 16,319 in 1957-58 to 14,535 (10 percent decrease). The annual attendance of educational groups at the State Museum has increased at a net adjusted rate of almost 2 percent a year. The usual net adjusted rise in tours is even higher. Since both these percentages are adjusted with regard to the net total population increase in New York State, the Museum seems to be attracting a larger segment of the total population annually.

Eighty-three percent of those visiting in groups were school classes, and the remaining 17 percent represented organizations, such as Scouts, 4-H groups, church clubs and resident and day camps. Distribution by category and services is shown in the following tables:



Classroom demonstrations are enjoyed by visiting school groups. These are combined with guided tours of related Museum exhibits.

School Group Analysis

GRADES	TOTAL ATTENDANCE	TOURS		INTRODUCTORY TALKS	
		NUMBER	ATTENDANCE	NUMBER	ATTENDANCE
K, 1-3.....	3,691	113	2,549	1	40
4-6.....	8,474	280	5,946	—	48
7-9.....	9,669	136	3,884	1	280
10-12.....	1,086	16	399	2	—
Multigraded...	868	18	543	—	—
Unclassified....	84	2	35	—	—
College.....	658	16	210	—	—
Adult Educ....	46	2	36	—	—
	24,576	583	13,602	4	368

Nonschool Group Analysis

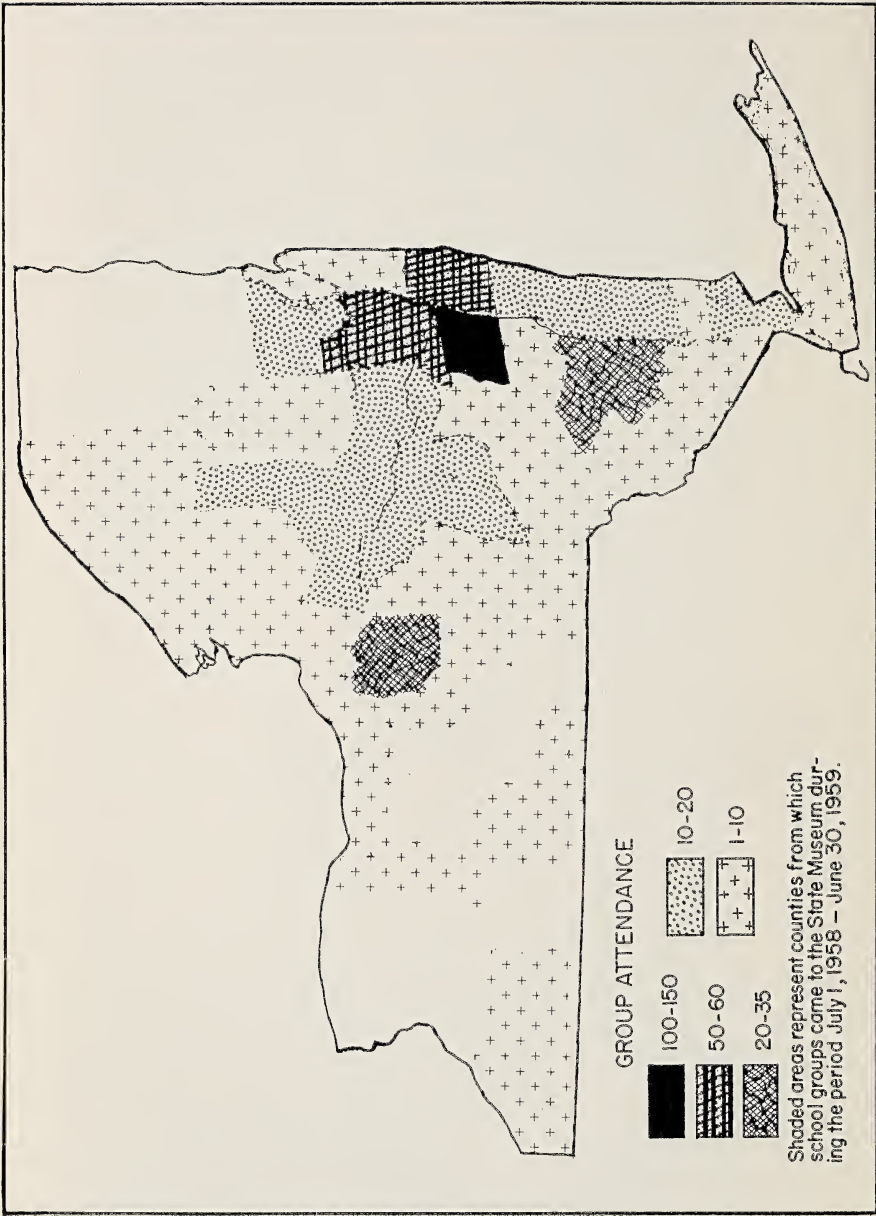
AGE LEVEL	NUMBER OF GROUPS	TOTAL ATTENDANCE	TOURS		INTRODUCTORY TALKS	
			NUMBER	ATTEND- ANCE	NUMBER	ATTEND- ANCE
Youth....	157	3,890	28	647	2	214
Adult....	11	1,212	11	286	1	16
Family Groups..	—	—	—	—	—	—
	168	5,102	39	933	3	230

School groups visiting the Museum came from 45 counties of New York State and from Ohio, Massachusetts and Vermont. Most of the groups came from within a 50-mile radius of Albany; however, there was good representation from Herkimer, Westchester, Onondaga and Suffolk Counties. The shaded areas on the map (page 52) show the counties of origin of visiting school groups.

Related Activities

Two form letters for tour requests were composed and printed. It is hoped that these will reduce the amount of time spent in answering mail. A letter to the Legislature was prepared which requests cooperation in scheduling tours for the large legislator-sponsored school groups which descend abruptly upon the Museum every March. This measure should reduce crowding and confusion in the Museum halls during this period.

On October 30 and April 18, the Education staff held three-hour workshops for teachers enrolled in Professor Deering's extension course at Bugbee School, State University College of Education at Oneonta. The topic was "How To Use the State Museum." The workshop consisted of a lecture and a guided tour. There was excellent response dur-



ing the school year from the members of the class who taught in area schools.

During the past year, the stock at the sales desk has been extended to include publications, records and kits. The kits have sold especially well during the short period that they have been available. The sales list for these outside publications, which totaled approximately \$600, was:

- 421 Copies of various books and leaflets
- 187 Booklets on dinosaurs
- 120 Booklets on insects
- 181 Publications on the American Indian
- 227 Cards
- 73 Boxes of notepaper
- 28 Kits of fish banners and mastodon skeletons
- 6 Record albums of bird songs
- 4 Subscriptions to *The New York State Conservationist*

Museum Library

REGULAR SERVICE CONTINUED during the year. Approximately two hundred additional books were borrowed from the New York State Library with only a small fraction of the number returned. The total number of State Library books on indefinite loan to the staff is constantly increasing.

Items accessioned in the Museum Library periodical file increased to 3,580 as compared with 3,276 in the preceding year. Duplicates and selected periodicals dated prior to 1950, of doubtful value to the staff, were taken to the State Library, Gift and Exchange Section. The U. S. Department of Agriculture Experiment Station Record vol. 1, 1889, through vol. 77, 1937, was also sent to Gift and Exchange because of limited space. It will be available for loan to the staff from the State Library.

The following Honoraria Reports were received: *Heavy Minerals in the Glacial Drift of Western New York*, by G. Gordon Connally; *Preliminary Report and Geologic Map of the Schunemunk, N. Y. Quadrangle*, by K. R. Kothe; *Statistical Analysis of Regional Facies Change in Ordovician Cobourg Limestone in Northwestern New York and Southern Ontario*, by L. Lippitt; and *Geology of Camp Drum, New York; A Preliminary Report*, by Paul W. Long.

Three gift books were received, presentations of the University of Pennsylvania Library, the William C. Whitney Foundation and Dr.

Paul Hahn, respectively. The State Library purchased 21 new books for the Museum staff under the departmental loan arrangement. The staff recommended purchase of 73 books and 13 periodicals by the State Library. All books and periodicals mentioned above were checked through the museum librarian. The volume of interlibrary loans increased markedly. Forty-four items were obtained for our staff by the State Library; many of these took considerable searching time.

A list of selected *Geological Journals* (with call numbers) in the New York State Library was prepared for the use of the Geological Survey. Basic work in the preparation of a bibliography on the Iroquois has been completed. A mailing list to be used for the review and notification of Museum publications has been prepared and coded. From this list, addressograph plates will be made. This innovation, it is hoped, will increase the circulation of Museum publications and save many hours of the typist's time.

Need for an improved method of accessioning Museum Library periodicals is still obvious. A visible record would save time and space.

Photography

A TOTAL OF 145 REQUESTS for the services of the museum photographer resulted in 335 black and white photographs taken, 1,671 negatives processed from field photographs and 2,920 prints and enlargements made from the preceding. In addition, 93 projection slides were prepared, 103 color photographs were taken and 88 special enlargements were made of new exhibits.

The above work included both field and office assignments. Some of the major subjects were a series of photographs showing a guided tour of visiting students arriving at the Museum and their progress through the exhibit halls; 4-H Capital Day delegates; events such as "Sunday Musicales"; open house at the State Museum; records of temporary exhibits and progress of construction and completion of permanent exhibits. Borrowed exhibit material was photographed before being returned to the lenders. Promotion ceremonies for members of the Museum staff were photographed and photographic records were made of damage from vandalism in the exhibit halls.

Photographs of material in the collections were made and prints were supplied to the Niagara Power Authority for preparation of a mural. Other photographs were made for institutions and scientists in foreign countries and for schools, book publishers and scientists in America. Prints of numerous subjects were furnished for use in a number of manuscripts destined to become Museum bulletins, and a series of bird

eggs were photographed and prints were prepared for reproduction in *The New York State Conservationist*.

In addition, a considerable amount of copy work was undertaken on charts, drawings and maps for slide preparation, illustrations for scientific reports and field mappings.

Requests for photographic services by the Commissioner's office included photographs of retiring Department employees, progress photographs of construction of the addition to the Education Building, professional meetings and members of the Commissioner's Cabinet.

Publications

MOST OF THE MANUSCRIPTS which were submitted by the staff for publication were edited by the Department editorial office and were sent to the printer without material delay. It was necessary to hold one paper over from the previous year, however, because of the expense of publication. At the close of 1958-59, only one manuscript (which had been completed but a short time previously) was awaiting editing.

Four Museum Bulletins (including an annual report) and 1 miscellaneous item were printed during the year. These 5 numbers totaled 396 pages of text and 147 plates, figures, maps and tables. Another paper of more temporary value was multilithed; it comprised 42 pages and one map. This "production" was only one-third of the printing secured in the previous year when a backlog of manuscripts had accumulated. However, the output of technical papers promises to increase materially during 1959-60.

At the end of the year, 7 technical manuscripts were in press for publication by the State Museum. One paper was in the field of archeology, 2 in botany, 2 in geology, 1 in paleontology, and 1 in zoology. Six additional manuscripts had been accepted by the editors of "outside" media. Fourteen others were in the writing stage—1 in archeology, 1 in botany, 3 in entomology, 6 in geology and 3 in paleontology.

Publications

State Museum and Science Service

- 1959 120th Annual report of the New York State Museum and Science Service, July 1, 1957-June 30, 1958. N. Y. State Mus. & Sci. Serv. Bull. 374. Jan. 1959. 63pp. 10 pl.

Jamnback, H. & Wall, W.

- 1959 The common salt-marsh tabanidae of Long Island, N. Y. State Mus. & Sci. Serv. Bull. 375. July 1959. 77pp. 27 fig.

Offield, T. W.

- 1958 Mineral production in New York State, 1950-56. N. Y. State Mus. & Sci. Serv. Nov. 1958. 19pp. 14 charts, 10 tab.

Reilly, E. M. & Parkes, K. C.

- 1959 Preliminary annotated checklist of New York State birds. N. Y. State Mus. & Sci. Serv. 1959. 42pp. 1 map.

Ritchie, W. A.

- 1959 The Stony Brook site and its relation to archaic and transitional cultures on Long Island. N. Y. State Mus. & Sci. Serv. Bull. 372. Jan. 1959. 169pp. 7 fig. 2 tab. 53 pl.

Stein, R. C.

- 1958 Two populations of the alder flycatcher. N. Y. State Mus. & Sci. Serv. Bull. 371. July 1958. 63pp. 6 fig. 18 tab.

In "Outside" Media

Collins, D. L.

- 1958 Some spiders of New York State. N. Y. State Conservationist, v. 13, No. 1, pp. 2-4. Aug.-Sept. 1958.
- 1959 Developments in forest pesticides in New York. New York Forester. May 1959, 16(2): 22-26

Connor, Paul F.

- 1959 The bog lemming, *Synaptomys cooperi*, in southern New Jersey. The Museum, Michigan State University, Biological Series, 1(5): 161-248. 1959

Fenton, W. N.

- 1959 "Folklore." (American Indian). Encyclopaedia Britannica. March 3, 1958.

Kreidler, W. L.

- 1959 Gas and oil developments in New York State in 1958. Amer. Assn. of Petroleum Geologists, v. 43, No. 6, June 1959, pp. 1139-1143
- 1959 Gas and oil developments in New York State in 1958. National Oil Scouts & Landsmen's Association. Yearbook, 1959. Review of 1958.

Reilly, E. M.

- 1959 Eggs and nests. New York State Conservationist, v. 13, No. 6, pp. 22-26. June-July 1959

Ritchie, W. A.

- 1958 (Review of) The Adena people, No. 2, by W. S. Webb and R. S. Baby. American Antiquity, v. 24, No. 2, pp. 211-212, Oct. 1958
- 1959 Archeology: Western Hemisphere, Encyclopaedia Britannica, Book of the Year, pp. 50-52. 1959

Van Tyne, A. M.

- 1958 New York. American Institute of Mining, Metallurgical and Petroleum Engineers. In a volume, Statistics of Oil and Gas Production in 1958.

Appendix A

1959 Graduate Student Honoraria Recipients

Anthropology

BUEDINGEN, ROBERT W.	Columbia University	Museum survey of Iroquoian (agriculture) materials	\$192
TAYLOR, DONNA	Columbia University	Cataloging and analyzing Iro- quois wampum collections in New York State	504

Botany

BRODO, IRWIN M.	Cornell University	Lichen ecology of Long Island	288
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Geology

BERMAN, BYRD L.	Columbia University	Petrological and ore genesis study of Clinton iron beds	240
CUTCLIFFE, WILLIAM E.	Rensselaer Poly- technic Institute	Geological mapping of North Troy and Tomhannock quad- rangles	420
DODD, ROBERT T., JR.	Princeton University	Geological mapping of Schune- munk quadrangle	504
NUGENT, ROBERT C.	University of Rochester	Stratigraphy and sedimentation study of some Upper Devonian strata	504
PLATT, LUCIAN B.	Yale University	Geological mapping of Cossayuna quadrangle	480
SIMMONS, M. G.	Harvard University	Gravity survey of Adirondack area	504

Zoology

COLER, ROBERT A.	Syracuse University	Biological, physical, and chemical analyses of a polluted stream	504
WHITAKER, JOHN O., JR.	Cornell University	Natural history of the meadow jumping mouse	408

\$4,548

Appendix B

Conferences and Professional Meetings in which the Museum and Science Service Staff participated.

- American Anthropological Association, Washington, D. C.—Fenton*, Ritchie*
American Association of Museums, annual meeting, Pittsburgh—Cahalane
American Ethnological Society, annual and spring meetings, New York and Brooklyn—Fenton
American Folklore Society, annual meeting, New York—Fenton
American Institute of Biological Sciences, Canada—Connor
American Institute of Mining Engineers, Bloomington, Indiana—Broughton
American Ornithologists Union, annual meeting, New York City—Palmer, Reilly
American Philosophical Society Library Committee; Conference on Research in American-Indian Studies—Fenton
American Society of Mammalogists, Washington, D. C.—Connor
Association of American State Geologists—Broughton
Conference on Archeological Sites, University of Syracuse—Ritchie
Conference on Conservation Research, College of Forestry, Syracuse (April)—Broughton, Cahalane, Collins and Fenton
Conference of Directors of Systematic Collections, (Research Museums) Gainesville, Florida—Fenton
Conference on Moravian Archives, Bethlehem, Pa.—Fenton
Conference with U.S.G.S. personnel at Washington—Broughton (with respect to the State Geological Map)
Eastern States Archeological Federation, Wilmington, Del.—Gillette, Ritchie*
Entomological Society of America, Baltimore, Md.—Collins, Connola, Jamnback
Federation of New York State Bird Clubs, Inc., Syracuse—Palmer, Reilly
Forest Insect Survey Conference, New Haven, Conn.—Connola
Forest Tree Improvement Conference, Beltsville, Md.—Collins
Geological Society of Canada—Borst, Isachsen
Gypsy Moth Conference, New Haven, Conn.—Campbell (Temporary Expert), Collins, Connola
Gypsy Moth Control Conference, New York City—Collins
International Conference on Scientific Information, Society for Ethno-history, Washington, D. C.—Fenton
Massachusetts Archeological Society, Worcester, Mass.—Ritchie
Mohawk-Caughnawaga Museum, Fonda—Gillette
Mosquito Control and Wildlife, Washington, D. C.—Collins
New Jersey Mosquito Extermination Association, Atlantic City, N. J.—Jamnback
New York Academy of Sciences Symposium—Broughton, Isachsen, Offield
New York State Air Pollution Control Board—Ogden
New York State Archeological Association, Rochester, N. Y.—Fenton, Ritchie*
New York State Archeological Association, (Van Epps-Hartley Chapter), Albany—Fenton, Gillette, Ritchie
New York State Forest Pest Control Survey—Collins, Connola

* Read formal paper.

New York State Geological Association—Borst
North American Wildlife Conference, New York City—Palmer
Northeastern Forest Pest Council, summer meeting, Boothbay Harbor, Maine—
Connola
Northeastern Forest Pest Council, Boston, Mass.—Collins, Connola
Northeast Museums Conference, Wilmington, Del.—Fenton
Northeastern Mosquito Control Association, Boston, Mass.—Jamnback
Northeastern Weed Control Conference—Ogden
Northern Gas & Oil Scouts Association—Van Tyne
Pennsylvania Grade Crude Oil Association—Kreidler, Van Tyne
Society for American Archeology, member, Highway Salvage Committee—
Ritchie
Society of American Foresters, Albany, N. Y.—Collins, Connola
Society of American Foresters, New York Section, Syracuse—Collins, Connola
U. S. G. S. Geologists' Conference, Washington, D. C.—Fisher, Richard
Wenner-Gren Foundation Viking Fund Awards Dinner, New York City—
Fenton, Ritchie
Wilson Ornithological Society, Rockland, Maine—Palmer
World Petroleum Congress—Kreidler, Van Tyne

Appendix C

Cooperative Work (Service): Talks given by the staff of State Museum and Science Service to various groups.

Adirondack Mountain Club—Collins
Alan Devoe Bird Club—Reilly
Albany Chapter of Nature Conservancy—Ogden
Brown University, Anthropology class—Fenton
Castleton Elementary School—Reilly
Chatham Central School—Reilly
Coeymans-Ravena Garden Club—Wilcox
Cohoes Elementary School—Ogden, Reilly
Colgate University—Broughton
Exchange Club of Albany—Fenton
Fort Orange Council, Boy Scouts of America—Reilly
Gloversville Garden Club—Reilly
Gloversville Rotary Club—Cahalane
Guilderland Central School—Reilly
Kinderhook Garden Club—Reilly
Men's Garden Club—Wilcox
Newburgh Free Academy—Fisher
New York State Federation of Garden Clubs—Collins
Philip Livingston Junior High School, panel—Reilly
Piseco Lake Town Board—Jamnback
Saddlewood Elementary School—Wilcox
Sanford Memorial Lecture, Rensselaer Polytechnic Institute—Fenton
Saranac Lake Town Board—Jamnback
Social Science Club of Mount Holyoke College—Fenton
State University College of Education at Albany, Biology Club—Koster
State University College of Education at Albany, panel—Reilly
State University College of Education at Oneonta—Koster
Tupper Lake Town Board—Jamnback
Van Rensselaer Garden Club, Troy—Reilly

Appendix D: Cooperating Agencies

A common function of the Museum and Science Service is to cooperate with agencies and organizations concerned with museum and research activities in this and other States, with government of U. S. and Canada, with universities and industry in the discovery, analysis and dissemination of scientific information. These contacts are frequently of reciprocal services and they arise often out of the personal contacts of the staff, and if so listed would measure individual participation, but they are here tabulated for the organization. By no means complete, the list indicates ranges of cooperative activity.

Adirondack Museum
 American Cyanamid Co.
 American Ornithologists Union
 Brookhaven National Laboratory
 California Department of Mines
 California Institute of Technology
 Canadian Department of Agriculture
 Canadian Biological Survey
 Cornell University, College of Agriculture
 Cranbrook Institute of Science
 Eastern New York Botanical Club
 Federation of New York State Bird Clubs
 Griffiths Air Force Base
 Harvard University
 Kansas State College
 Lamont Geological Observatory
 National Park Service
 New York Botanical Garden
 New York State Department of Agriculture & Markets
 New York State Department of Commerce
 New York State Department of Conservation
 New York State Department of Public Works
 New York State Health Department
 New York State Highway Department
 New York State Police Department, B.C.I.
 Office of Atomic Development
 Quebec Geological Survey
 Royal Ontario Museum
 Shell Chemical Co.
 St. Bonaventure University
 State University College of Education at Albany
 State University College of Education at Oneonta
 State University College of Ceramics
 State University College of Forestry
 State University Harpur College
 Suffolk County Mosquito Control Commission

Syracuse University
 Torrey Botanical Club
 Town of Webb
 Union Carbide and Chemical Corporation
 U. S. Bureau of Mines
 U. S. Fish and Wildlife Service
 U. S. Forest Service
 U. S. Geological Survey
 U. S. National Museum
 University of Iowa
 University of Massachusetts
 University of Michigan
 University of Tennessee
 University of Wisconsin
 Velsicol Corporation
 WGY Farm Forum of the Air

Appendix E: Professional Affiliations

Adirondack Mountain Club, vice chairman—Cahalane (reelected)
 Albany Club of the Society of the Sigma XI, secretary—Fisher
 American Ethnological Society, president—Fenton
 American Folklore Society, president—Fenton
 American Institute of Mining Engineers, Industrial Minerals Division,
 chairman, 1959-60—Broughton
 American Institute of Mining Engineers, Industrial Minerals Division,
 secretary-treasurer, 1958-59—Broughton
 American Society of Mammalogists, member, Board of Directors—Cahalane
 Second Conference of Directors of Systematic Collection, (Research Museums),
 Albany, N. Y., chairman—Fenton
 Entomological Society of America, (Section on Shade Trees and Ornamentals
 of Eastern Branch), chairman—Collins; also member, Program Committee
 Fifth World Forestry Congress (Section on Wildlife and Recreation), Program
 Committee, member—Cahalane
 Grassland Research Foundation, Inc., member, Scientific and Advisory
 Board—Cahalane
 Mosquito News, editor—Collins
 National Parks Association, president—Cahalane
 New York State Archeological Association, chairman, Committee of Chapters
 and Memberships—Ritchie
 New York State Archeological Association, treasurer—Gillette (reelected)
 Northeastern Forest Pest Council, member for New York State—Collins
 Northeastern Forest Tree Improvement Committee, member for New York
 State—Collins
 Northeastern Mosquito Control Association, president—Jamnback
 Society of American Foresters, New York Section, member, Committee on
 Forest Insects and Diseases—Connola
 Society of Mining Engineers, director, AIME, 1959-60—Broughton

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By

PAUL F. CONNOR
Scientist (Zoology)



**NEW YORK STATE MUSEUM
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*The University of the State of New York
The State Education Department*

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THE UNIVERSITY OF THE STATE OF NEW YORK

Regents of the University

With years when terms expire

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State Zoologist, State Science Service

RALPH S. PALMER, Ph.D.



CONTENTS

	PAGE
INTRODUCTION AND ACKNOWLEDGMENTS.....	5
DESCRIPTION OF REGION.....	7
LIST OF MAMMALS OF OTSEGO AND SCHOHARIE COUNTIES	10
ACCOUNTS OF SMALL MAMMALS	13
Masked shrew	13
Smoky shrew	15
Big-tailed shrew	18
Pygmy shrew	22
Short-tailed shrew	23
Hairy-tailed mole	26
Star-nosed mole	27
Little brown bat	29
Keen's bat	31
Eastern pipistrelle	32
Big brown bat	33
Red bat	33
Hoary bat	34
Eastern cottontail	35
New England cottontail	36
Eastern chipmunk	37
Gray squirrel	39
Red squirrel	40
Southern flying squirrel	42
Northern flying squirrel	43
Deer mouse	47

	PAGE
White-footed mouse	49
Southern bog lemming	51
Red-backed mouse	55
Meadow vole	58
Pine vole	61
Norway rat	63
House mouse	63
Meadow jumping mouse	63
Woodland jumping mouse.....	65
Short-tailed weasel	68
Long-tailed weasel	69
APPENDIX ON FLEAS COLLECTED.....	79
REFERENCES CITED	81

INTRODUCTION AND ACKNOWLEDGMENTS

In June 1956, the author was engaged by the New York State Museum and Science Service to begin a survey of small mammals in Otsego County. Work was carried out in Otsego County until April 1957, after which operations were shifted to adjoining Schoharie County. Here fieldwork was conducted from May 1957 until September 1958, with occasional collecting undertaken after the latter date.

The objectives of this study were as follows: (1) to collect small mammal brain tissue as part of a State interdepartmental project attempting to determine whether, and to what extent, various small mammals are reservoir hosts of the disease rabies; (2) to obtain, whenever possible, basic information on the biology and life history of the species collected; (3) to obtain ecological information relating to the occurrence and distribution of the various small mammals in the region; and (4) to augment the mammal collections of the State Museum. Throughout the study emphasis has been on the smaller species, primarily those smaller than the cottontail rabbit.

All mammal specimens prepared as study skins or skeletons are deposited in the collection of the New York State Museum in Albany. Information gathered relating to the habitat preference, habits and biology of the various species is given in the body of this report under the separate species accounts. This information is based chiefly on the field and laboratory notes of the author. All measurements given were made by the author.

Traplines were operated in numerous localities in both counties. Trapping efforts were especially concentrated in Gilbert Lake State Park and in the vicinity of Otsego Lake in Otsego County, and in the regions of Summit, Burnt Hill (near North Blenheim), Petersburg Mountain (near Cobleskill), and Gilboa in Schoharie County. But trapping localities also were well spotted over the entire region. An effort was made to sample a large variety of small mammal habitats at high and low elevations; as a rule, those habitats more productive in numbers of species and specimens were trapped more intensively. In order to obtain representative specimens for all seasons of the year trapping was conducted during every month, being suspended only occasionally during the most severe weather in midwinter. Individual traplines were usually run for a period of several days but with a variation ranging from two days to two months. The type of trap commonly used for mice, shrews and moles was the regular-sized mouse snap trap with a wood pedal; sunken cans,

often half-filled with water, were used as "tumble-in" traps in some localities. For larger species such as squirrels and weasels, rat snap traps were used. Bats were collected by shooting or netting, or by picking them off their summer or winter roosting places.

Throughout much of the study efforts were made to save fleas and other ectoparasites. The fleas have been identified by Dr. Allen H. Benton and Donald H. Miller, and their valued contribution has been included separately as a special appendix at the end of this paper. Otsego County fleas were identified by Donald H. Miller in his study of the siphonapterous parasites of the small mammals of Otsego County, done while working for an advanced degree at the State University College of Education at Albany. Dr. Benton, of the Biology Department of the same institution, aided Mr. Miller in his work, and in addition identified the fleas collected in Schoharie County. At the time of this writing some of the Schoharie County fleas as well as other parasites collected are awaiting identification.

Otsego and Schoharie Counties are located in an area of high rabies incidence. Because a large proportion of foxes are found to be infected with this disease in comparison with other forms of wildlife in this area, the New York State Conservation Department has been conducting a fox trapping program in an attempt to control the disease (see Colson, et al., 1955). The possibility that small mammals such as shrews, bats and rodents may serve as unrecognized reservoirs of infection stimulated the launching of a special New York State rabies project involving the smaller species. This brought the State Education Department (of which the State Museum and Science Service is a part) into cooperation with other departments already engaged in various aspects of the rabies investigation.

The plan called for the author, as the field mammalogist, to collect small mammal tissue, chiefly brains, in a condition suitable for rabies diagnosis by the Health Department, which was working in conjunction with the Conservation Department. Dr. Richard L. Parker of the Health Department was in charge of receiving and testing material submitted. As of March 31, 1958, approximately 1,160 brains and 35 pairs of salivary glands representing the following genera were submitted and tested: *Sorex*, *Blarina*, *Parascalops*, *Condylura*, *Myotis*, *Eptesicus*, *Tamias*, *Tamiasciurus*, *Peromyscus*, *Synaptomys*, *Clethrionomys*, *Microtus*, *Pitymys*, *Rattus*, *Mus*, *Zapus*, *Napaeozapus* and *Mustela*. No cases of rabies were diagnosed from this material. However, an increasing number of States are joining the list of States reporting bats infected with rabies, and in 1956, the first year of the present study, the first such case was reported for New York, from a big brown bat, *Eptesicus*

fuscus, collected in Rensselaer County by Dr. Allen H. Benton and turned over to Dr. Parker, who isolated the virus (Anon., 1956).

In Otsego County, field headquarters were maintained in Gilbert Lake State Park during the first half of the period and at the Farmers' Museum in Cooperstown during the remainder of the time in that county. Appreciation is expressed to the Division of State Parks and to the Farmers' Museum for the accommodations. In Schoharie County, field headquarters were maintained throughout the period at Richmondville.

Summer help was assigned to this study during the three summers included. During the summers of 1956 and 1957, Donald H. Miller, then a graduate student at the State University College of Education at Albany, ably assisted in both field and laboratory work. During the summer of 1958 two Cornell University students, John O. Whitaker (graduate student) and Gene Whitaker, helped out for a period of several weeks.

This survey was carried out under the direction of Dr. Ralph S. Palmer, State Zoologist. I wish to thank Dr. W. J. Hamilton, Jr., Cornell University, for his critical reading of the manuscript and important suggestions regarding it. Dr. Palmer and Victor H. Cahalane, Assistant Director of the State Museum, also lent aid in the preparation of the manuscript. Dr. Edgar M. Reilly, Jr., curator of zoology, prepared the map showing the location of the region. Besides those already mentioned, I wish to thank the following persons who have helped in various ways: Stanley J. Smith, curator of botany, New York State Museum; Fred Barnard, game protector, Otsego County, and George L. Couse, superintendent, and Ralph Brightman, patrolman, Gilbert Lake State Park.

DESCRIPTION OF REGION

Otsego and Schoharie Counties are situated adjacent to one another in east-central New York (figure 1) and encompass areas of 1,009 and 620 square miles, respectively. Physiographically, these counties lie within the glaciated Appalachian Plateau, a highland area dissected by numerous streams. This erosional plain (peneplain), at a level of approximately 2,000 feet, extends unbroken across much of central and south-central New York, and the counties discussed here are on an "arm" of this physiographic unit which extends east of Schoharie County into Albany County as far as the Hudson River Valley. The Mohawk River lies just to the north of Otsego and Schoharie Counties and its valley parallels their northern borders, while the Catskill Mountains are located to the south and southeast of this region, their foothills corresponding rather closely in places with the southern boundaries of these counties.

Thus in elevation and roughness of topography most of the region under consideration is, in a general way, intermediate between neighboring areas north and south, although the exact boundaries of the counties are primarily artificial.

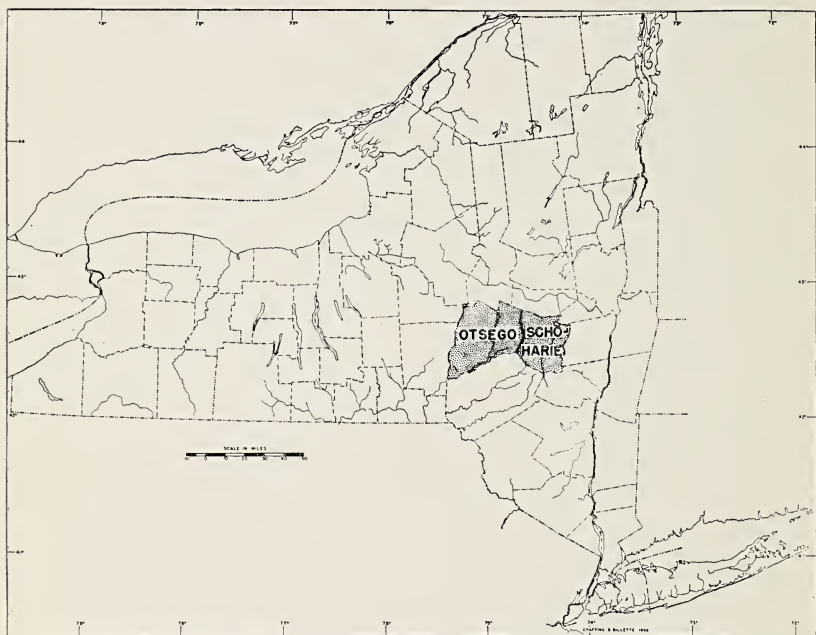


Figure 1. Map of New York State showing location of Otsego and Schoharie Counties.

The dissection of the plateau has resulted in a rounded topography with comparatively sharp, narrow valleys; the broad, flat hilltops tend to have a remarkably uniform altitude. Most of the land lies between 1,000 and 2,000 feet in elevation with an extreme range of from 600 to 3,200 feet; both extremes are found in Schoharie County, elevations in Otsego County showing a more limited range. In general, the terrain is rolling in the north, with a larger proportion of steep slope in the south. The maximum height to be found in most of Schoharie County is a level of about 2,300 feet, which is reached in several places, and this was the highest altitude trapped in this study. On the extreme southern boundary of this county along the Greene County line, Catskill foothills rise as high as 3,000 feet and slightly more. The rough, mountainous Catskills are

actually a part of the plateau, but rise to 4,000 feet, another 2,000 feet above the general level of the plateau, and thus constitute a separate unit (Rich, 1934). In the extreme northern part of Otsego and Schoharie Counties the land levels out in a gradual descent toward the Mohawk Valley. An escarpment cuts off the northern one-fourth of Schoharie County and the extreme northeastern corner of Otsego County, with a lower elevation prevailing to the north of it.

Almost all of Otsego County drains toward the southwest by way of the Susquehanna River (which rises at Otsego Lake in the northern part of the county) and its tributaries. In Schoharie County, on the other hand, the direction of drainage is toward the north by way of Schoharie Creek, except for the extreme southwest corner which is drained by the Susquehanna and Delaware Rivers. Schoharie Creek originates in the Catskills and flows north through the eastern part of Schoharie County to join the Mohawk, which in turn flows east to the Hudson River. Small lakes, ponds and small swampy areas are fairly numerous in the region. The only sizeable bodies of water are Canadarago and Otsego Lakes in the northern part of Otsego County, of which the latter, 8 miles long, is the larger.

The rocks are chiefly Devonian in age, primarily sandstone and shale, but upper Silurian and lower Devonian limestone forms a belt across the northern part of the area. Soil productivity ranges from low to high (Maxon and Fuller, 1915; Tharp et al., 1940). The more fertile soils are found in the valleys, while much of the upland is of low agricultural value. During the last century most of the land, except steep stony slopes, was cleared for farms, but the hill country in general was unsuited to agriculture, resulting in much abandonment of land after 1900. A steady increase in forest acreage and a reversion toward original conditions is thus taking place over much of the upland country. Today many of the hills and the steeper slopes are wooded, while the valleys and the less rugged hillsides are chiefly open agricultural land. Dairy farming is now well established and is the dominant occupation, the other types of farms being only of local importance. In general, the winters are long and cold, the summers rather cool and pleasant in this area. The climate is less severe than the Adirondacks and Catskills, but more so than the Erie-Ontario Lake plain and the lower Hudson Valley.

This part of New York is included in the extensive hemlock-white pine-northern hardwoods region which is characterized by the pronounced alternation of deciduous, coniferous and mixed forests communities (Braun, 1950). Here sugar maple (*Alcer saccharum*), beech (*Fagus grandifolia*), yellow birch (*Betula lutea*), hemlock (*Tsuga canadensis*) and white pine (*Pinus strobus*) are, or were under original

conditions, the dominant and characteristic forest trees (Bray, 1930). Today there is little resemblance to original conditions in Otsego and Schoharie Counties, but much unused land is in various stages of returning to the former state. Many of the small forest mammals discussed in this report, as well as some of the larger game species, undoubtedly have profited by this trend back to forest conditions. Second-growth woods composed chiefly of sugar maple, or of maple, beech and hemlock, are common in the area; old second-growth woods with rather large hemlocks and white pines are not rare. Other common trees include black birch (*Betula lenta*), red oak (*Quercus rubra*), white oak (*Quercus alba*), American elm (*Ulmus americana*), black cherry (*Prunus serotina*), red maple (*Acer rubrum*), striped maple (*Acer pennsylvanicum*), basswood (*Tilia americana*), white ash (*Fraxinus americana*) and hop hornbeam (*Ostrya virginiana*). Locally there is considerable oak and hickory, intruding southern trees, while "boreal islands" of red spruce (*Picea rubens*) and balsam fir (*Abies balsamea*) occur in some localities at about 2,000 feet altitude or higher. Small coniferous and deciduous swamps are to be found, with stands of arbor vitae (*Thuja occidentalis*) frequent in the limestone belt in the northern part of the region. Coniferous reforestation plantations are frequent on abandoned land in many localities.

LIST OF MAMMALS OF OTSEGO AND SCHOHARIE COUNTIES

The list of 49 species given below includes, so far as I am aware, those mammals which are known to exist in Otsego and Schoharie Counties at the present time, or for which there are recent records of occurrence. Most of these species occur in both of the counties; a few at present are known only from one of the counties, for example the big-tailed shrew (Schoharie County). All the species on the list except European hare, New England cottontail, coyote, long-tailed weasel and otter were taken or recorded during the course of this survey. A total of 39 species were collected; only a few specimens of the larger species were taken, but opossums, woodchucks, beavers, porcupines, muskrats, red foxes, gray foxes, raccoons, skunks, mink and deer were commonly observed in both counties. The small mammals, with which this study was chiefly concerned, are treated in the discussion of species following this section; on the list these species are marked with an asterisk.

Opossum	<i>Didelphis marsupialis virginiana</i> Kerr
*Masked Shrew	<i>Sorex cinereus cinereus</i> Kerr
*Smoky Shrew	<i>Sorex fumeus fumeus</i> Miller
*Big-tailed Shrew	<i>Sorex dispar</i> Batchelder
*Pygmy Shrew	<i>Microsorex hoyi thompsoni</i> (Baird)
*Short-tailed Shrew	<i>Blarina brevicauda talpoides</i> (Gapper)
*Hairy-tailed Mole	<i>Parascalops breweri</i> (Bachman)
*Star-nosed Mole	<i>Condylura cristata cristata</i> (Linnaeus)
*Little Brown Bat	<i>Myotis lucifugus lucifugus</i> (LeConte)
*Keen's Bat	<i>Myotis keenii septentrionalis</i> (Trouessart)
*Eastern Pipistrelle	<i>Pipistrellus subflavus obscurus</i> Miller
*Big Brown Bat	<i>Eptesicus fuscus fuscus</i> (Palisot de Beauvois)
*Red Bat	<i>Lasiurus borealis borealis</i> (Müller)
*Hoary Bat	<i>Lasiurus cinereus cinereus</i> (Palisot de Beauvois)
Varying Hare	<i>Lepus americanus virginianus</i> Harlan
European Hare	<i>Lepus europaeus hybridus</i> Desmarest
*Eastern Cottontail	<i>Sylvilagus floridanus mearsii</i> (J. A. Allen)
*New England Cottontail	<i>Sylvilagus transitionalis</i> (Bangs)
Woodchuck	<i>Marmota monax rufescens</i> A. H. Howell
*Eastern Chipmunk	<i>Tamias striatus lysteri</i> (Richardson)
*Gray Squirrel	<i>Sciurus carolinensis pennsylvanicus</i> Ord
*Red Squirrel	<i>Tamiasciurus hudsonicus loquax</i> (Bangs)
*Southern Flying Squirrel	<i>Glaucomys volans volans</i> (Linnaeus)
*Northern Flying Squirrel	<i>Glaucomys sabrinus macrotis</i> (Mearns)
Beaver	<i>Castor canadensis</i> (Kuhl)
*Deer Mouse	<i>Peromyscus maniculatus gracilis</i> (LeConte)
*White-footed Mouse	<i>Peromyscus leucopus noveboracensis</i> (Fischer)
*Southern Bog Lemming	<i>Synaptomys cooperi cooperi</i> Baird
*Red-Backed Mouse	<i>Clethrionomys gapperi gapperi</i> (Vigors)
*Meadow Vole	<i>Microtus pennsylvanicus pennsylvanicus</i> (Ord)
*Pine Vole	<i>Pitymys pinetorum scalopoides</i> (Audubon and Bachman)
Muskrat	<i>Ondatra zibethicus zibethicus</i> (Linnaeus)
*Norway Rat	<i>Rattus norvegicus</i> (Berkenhout)
*House Mouse	<i>Mus musculus domesticus</i> Ruttj
Meadow Jumping Mouse	<i>Zapus hudsonius americanus</i> (Barton)
*Woodland Jumping Mouse	<i>Napaeozapus insignis insignis</i> (Miller)
Porcupine	<i>Erethizon dorsatum dorsatum</i> (Linnaeus)
Coyote	<i>Canis latrans</i> Say
Red Fox	<i>Vulpes fulva fulva</i> (Desmarest)
Gray Fox	<i>Urocyon cinereoargenteus borealis</i> Merriam
Black Bear	<i>Euarctos americanus americanus</i> Pallas
Raccoon	<i>Procyon lotor lotor</i> (Linnaeus)
*Short-tailed Weasel	<i>Mustela erminea cicognanii</i> Bonaparte
*Long-tailed Weasel	<i>Mustela frenata noveboracensis</i> (Emmons)
Mink	<i>Mustela vison</i> Schreber
Striped Skunk	<i>Mephitis mephitis nigra</i> (Peale and Palisot de Beauvois)
River Otter	<i>Lutra canadensis canadensis</i> (Schreber)
Bobcat	<i>Lynx rufus rufus</i> (Schreber)
White-tailed Deer	<i>Odocoileus virginianus borealis</i> Miller

Several additional small mammal species have been taken in central or eastern New York, but have not to my knowledge been recorded from the counties covered in this report. Undoubtedly some of these eventually will be taken within the confines of this region. Numerous trap nights along the most suitable appearing streams I could find yielded no water shrews (*Sorex palustris albibarbis*), although this species occurs in the Catskills south of this region. The least shrew (*Cryptotis parva*), essentially a southern species, has been taken several times in the region of Ithaca, Tompkins County (Hamilton, 1934) and at other widely scattered points in New York State. The silver-haired bat (*Lasionycteris noctovagans*) may be not uncommon in this region, since it is statewide in distribution and has been reported as common in several sections; it is the most abundant bat of the Adirondacks according to Merriam (1884). Two cave bats have been recorded in nearby counties and undoubtedly occur in small numbers in some of the caves of northern Schoharie County; these are the Indiana bat (*Myotis sodalis*) and the least brown bat (*Myotis subulatus leibii*). The former has been found hibernating in Albany County just east of this region (Griffin, 1940), while the least brown bat has been found in winter in an abandoned mine shaft in Montgomery County, which borders Schoharie County on the north (Schwager and Benton, 1956). The rock vole (*Microtus chrotorrhinus*) occurs in the Catskill Mountains, but this species was not taken in rocky areas in Schoharie County, although it possibly occurs rarely and locally in this county. The prairie deer mouse (*Peromyscus maniculatus bairdii*) and the least weasel (*Mustela rixosa*) are essentially western forms which may conceivably occur in small numbers here. The prairie deer mouse has been taken as far east as the Ithaca region (Hamilton, 1950) and the Susquehanna River Valley in northeastern Pennsylvania (Grimm and Whitebread, 1952), while the least weasel has been taken in Bradford County, Pennsylvania (Grimm and Whitebread, 1952) about 60 miles southwest of the borders of the present region.

ACCOUNTS OF SMALL MAMMALS

MASKED SHREW

Sorex cinereus cinereus Kerr

Specimens taken. 88 (Otsego County, 43; Schoharie County, 45), in every month of the year.

Distribution and habitat. The masked, or common shrew was trapped in many localities, although frequently only one or two were taken on a trapline. Nearly three times as many *Sorex fumeus* were caught, but such a proportion in numbers may not actually exist, since the smaller *cinereus* appears to be more difficult to capture in the ordinary mouse snap traps. This was sometimes suggested when sunken tin cans were used along with snap traps in a locality. In one trapline in the fall of 1956 in a partially wooded area, snap-trapping over a two-week period (about 1,000 trap nights) yielded among small shrews only 4 *fumeus*. When the snap traps were then replaced with 13 cans for the succeeding month, 7 *cinereus*, 3 more *fumeus* and a *Microsorex* were secured. In another area the catch of masked shrews was greatly increased by the use of cans.

In this region cool, moist woods, clearings and the marshy edge of lakes are favored environments. Specimens of *Sorex cinereus* were collected in the following main types of habitats, in order of numbers of shrews taken: deciduous and mixed woods, arbor vitae swamps, grassy woodland edges and clearings, marshy edges of lakes and ponds, and coniferous woods (these habitats were not all equally trapped). In a low-lying arbor vitae swamp near Otsego Lake during February and March 1957, *Sorex cinereus* was probably the commonest species of mammal. Eighteen of these shrews were trapped; only red-backed mice were caught in greater numbers, and these mice are much easier to trap than the small shrews. No specimens were secured at elevations less than 1,150 feet, but they probably occur at the lower elevations in some habitats. A seemingly unusual catch (for this region) was one taken on bare, stony ground in a hilltop field covered with goldenrod (*Solidago grammifolia*).

Most of the specimens were taken in traps set at holes and cavities in and about logs and stumps; some were trapped in the tunnels of larger insectivores and mice in the humus, and in *Microtus* runways in marshy areas. None were taken on talus slopes (or other extremely rocky areas) which in this region are favored by *Sorex fumeus*, and locally, *Sorex dispar*. In most areas where this species was trapped, smoky and short-tailed shrews also occurred, and sometimes all of these were taken in the

same traps on different days. Red-backed mice, other microtines and jumping mice were also frequent neighbors of the masked shrews.

Reproduction. The reproductive season was ascertained to extend at least from April through July. Four pregnant females were taken, as follows: May 16, 1958, 8 embryos at 7 mm. crown to rump; June 18, 1958, 8 embryos at 5 mm.; July 11, 1957, 6 embryos at 12 mm. crown to rump; July 20, 1956, 7 embryos at 12 mm. crown to rump. Nursing individuals were taken on May 1, 26 and June 18, 1958, and July 19, 1957; one on August 3, 1956, had apparently just finished nursing. The female trapped on June 18 was at the same time pregnant and lactating, indicating mating may follow parturition.

Adult males in apparent breeding condition were collected from April 19 to August 23; these had enlarged reproductive organs, with testes measuring about 4 to 6 mm. in length. All the 8 males taken during April, May and June were breeding adults. None of the 24 males collected from September to March were in breeding condition; these were all immatures and subadults, with small testes not measuring more than 1.5 mm. in length. This species was not collected between March 10 and April 19, but all the spring males trapped were in breeding condition on and after the latter date.

Measurements. During July and August, both adults (those born the previous year) and immatures were taken on the traplines. Shrews are short-lived animals, and by early fall most of the adults had been replaced by the young shrews, the latest adult trapped apparently being an old male taken on August 23. During the winter the new generation did not increase in weight, but with the breeding season a marked increase occurred.

Measurements of adults taken during the breeding season (April 19-August 23) are as follows. Twelve adult males average: weight, 4.4 grams (3.8-4.8); total length, 98.0 mm. (94-103); tail, 38.8 mm. (35-41.5); hind foot, 11.2 mm. (10.5-11.5). Nine adult females average: weight, 5.5 grams (4.4-7.2); total length, 100.4 mm. (94-106); tail, 39.0 mm. (36-41); hind foot, 11.0 mm. (10.5-12). Most of the females were with embryos or had well-developed mammary glands; the heaviest (6.7 and 7.2 grams) had large embryos. All the males had large reproductive structures and appeared to be in breeding condition.

Young adults (subadults) taken before the onset of the breeding season weighed considerably less, none being over 4 grams in weight, while during the breeding season all but one weighed over 4 grams. The subadults also averaged somewhat shorter in total length. Thirty of these, representing all specimens trapped from November to March,

measured as follows. Nineteen males average: weight, 3.3 grams (2.9-4.0); total length, 95.4 mm. (91-101); tail, 39.7 mm. (38-43); hind foot, 11.2 mm. (10.5-12). Eleven females average: 3.1 grams (2.9-3.6); total length, 95.3 mm. (92-103); tail, 39.7 mm. (38-41); hind foot, 11.3 mm. (10.5-12.5).

SMOKY SHREW

Sorex fumeus fumeus Miller

Specimens taken. 249 (Otsego County, 46; Schoharie County, 203), in every month of the year.

Distribution and habitat. This shrew is primarily a forest species, its favorite haunts in this region being the cool, northern deciduous and mixed forests of sugar maple, beech, birch and hemlock, although not absent from stands of red and white oaks, red maple and white pine and other trees. Smoky shrews were frequently trapped in the tunnels of mice and moles in the leaf mold, in cavities in rotten logs and stumps, and in dark recesses among the rocks in ravines and talus slopes. That these shrews also run about over the leaf litter on the forest floor was indicated by four specimens which were caught in rattraps baited with walnut meat for squirrels and placed on the ground near trees and logs.

Smoky shrews were usually represented on traplines in upland forest habitats, and often made up an appreciable portion of the catch. In some areas it was at times probably the most numerous member of the small mammal community. This was especially true among the tumbled rocks of the steep talus slopes; at one such locality (elevation 1,300 feet) on the west side of Reed Hill, overlooking the Schoharie Creek Valley near Gilboa, more *Sorex fumeus* were taken than any other small mammal, 53 out of 176 mice and shrews trapped in 1957 and 1958 consisting of this species. In this area, where *Sorex dispar* also occurred, birches, mountain maple and scattered hemlock grew among the rocks. Smoky shrews were also abundant, at least during the spring and summer of 1958, in woods composed chiefly of sugar maple on the top of Petersburg Mountain (elevation 2,300 feet) near Cobleskill. Here, in the numerous tunnels in the humus and about rotten stumps, 55 smoky shrews were captured out of a total of 156 small mammals.

Very few of these shrews were taken in the arbor vitae swamps and small boreal islands of red spruce and balsam fir, where *Sorex cinereus* was more apt to be encountered, although *fumeus* was common enough in hemlock groves in the woods. Masked shrews also outnumbered this species in the open, marshy ground between the woods and shores of ponds and lakes. *Sorex fumeus* was, however, often taken under rocks

and banks along the margins of swift woodland streams where we trapped in vain for water shrews. Grassy or weedy clearings in the woods, especially where there were old stumps and the like, were also good places to trap for smoky shrews.

In an old overgrown field (elevation 2,000 feet) near Cobleskill in October 1957, 15 *Sorex fumeus* were taken in company with *Microtus pennsylvanicus* and *Blarina* in mats of bluegrass and among the stems of goldenrod, raspberry and small white ash saplings. Here the smoky shrews were utilizing both the surface and subsurface runways of *Microtus*. Roslund (1951) speaks of taking this species in brushy fields of poverty grass (in *Synaptomys* runways) in north-central Pennsylvania.

Remarks. In several seemingly favorable wooded areas no smoky shrews were taken. *Blarina* was common in these areas, and in some of the areas especially heavy catches of the larger shrew were made. This suggested that the larger, predatory blarinas possibly had reduced the smoky shrew population. However, in some localities both shrews seemed common. There may on occasion be some relation between the populations of small shrews and *Blarina*; Hamilton (1940) and Jameson (1949) mention the possible role of *Blarina* in the reduction of numbers of *Sorex fumeus*. That such may occur was also suggested by trapping the same wooded area on Petersburg Mountain during two successive years. Trapping during the fall of 1957 produced 10 *Sorex fumeus* and 78 *Blarina*; trapping again during the following spring and summer yielded 55 *Sorex fumeus* (as mentioned previously) and only 16 *Blarina*. Possibly the high 1957 population of *Blarina* had held down the smoky shrew population, while the low 1958 numbers of the larger shrew (caused by exceptionally high winter losses, or my 1957 trapping?) had allowed the *Sorex* to build up its population. These population changes may have been entirely unrelated, and my figures may not be comparable because trapping was not carried out at the same seasons in both years.

During the record-breaking deep snows of January, February and March 1958, *Sorex fumeus* was one of the few trappable species smaller than squirrels, with such forms as moles, microtines and other small shrews being very difficult to obtain. The use of small snap traps usually was restricted to occasional spaces beneath log piles and upturned roots of large fallen trees, and to snow passages beneath elevated logs or fallen trees (depressions in the snow beneath the logs which were sometimes used as highways of small mammal travel). As the season progressed, snow gradually sifted into many of these places, making trapping more and more difficult. Under such conditions, with most of the traps placed on the snow in the snow passages, *Sorex fumeus* was often taken in

greater numbers than the other species. For example, on one line of such traps in February, 6 *Sorex fumeus*, 3 *Blarina* and 3 *Peromyscus maniculatus* were the only small specimens taken; another area, trapped in March, yielded just 11 *Sorex fumeus*, 2 *Blarina*, 2 *P. maniculatus* and 2 *P. leucopus*. Smoky shrews were taken on top of the snow even at below zero temperatures; one was caught in a rattrap baited with meat for weasels and set in a large space under a fallen tree where there were weasel tracks.

Reproduction. Hamilton (1940) gathered life history data on this species near Rensselaerville in the southwestern part of Albany County, just east of the region covered by this report. Findings in the present study relating to reproduction for the most part agree with the more extensive data given by that author. In the present study, gravid and lactating females were taken from April to July (table 1); no non-breeding adult females were taken during these months. The first sign of breeding activity among females was one with a swollen uterus on

TABLE 1
Reproductive data for female *Sorex fumeus*

DATE	NUMBER AND SIZE OF EMBRYOS	NUMBER OF PLACENTAL SCARS	REMARKS
March 26, 1957			Uterus swollen
April 16, 1957	6 (7 mm.)		
April 17, 1957	6 (11.5 mm. crown to rump)		Lactating
April 24, 1957	5 (3 mm.)		
April 27, 1958		6	Lactating
April 30, 1958		6	Recent parturition; lactating (?)
April 30, 1958		Present	Recent parturition; lactating (?)
May 2, 1958		5(?)	Lactating
May 8, 1958		7	Recent parturition; lactating
May 22, 1958		7	Lactating
June 21, 1957	4 (7 mm. crown to rump)		
June 24, 1958			Lactating
June 24, 1958			Lactating
July 3, 1957			Lactating
July 5, 1958	1 (2.5 mm.)		
July 17, 1957		Present	Lactating
July 19, 1956			Lactating

March 26, but three other females taken in late March showed no evidence of breeding activity. Embryo and placental scar counts average 5.3.

Young and subadult males which were taken during summer, fall and winter, had small testes usually measuring less than 1 mm. to about 2 mm. in length. Testes of adult breeding males measured about 5 to 8 mm. in length. As early as February 24 (1957) a male appeared to be coming into breeding condition, with testes measuring 4 x 3 mm., and with conspicuous side glands. A male taken on March 5 (1957) had minute testes, but all 10 males taken in the latter part of March (March 12-30, 1957, 1958) had enlarged testes and accessory structures. All the adult males taken during April, May, June and July appeared to be in breeding condition.

The first juvenile was trapped on May 30; after July the proportion of adults to young decreased rapidly as the old population disappeared, which is typical for these shrews, most of the adults apparently dying off in late summer (Hamilton, 1940). An adult male with enlarged reproductive structures trapped on September 17 was, I believe, the latest adult male taken in this study. However, a seemingly very old adult female, with well-worn teeth, was trapped on December 13; this one was probably entering its second winter.

Measurements. Thirty-nine adult males, all of which had enlarged reproductive structures, average: weight, 8.0 grams (6.0-10.1); total length, 119.6 mm. (114-129); tail, 46.2 mm. (41-51); hind foot, 12.7 mm. (12-13.5). Thirteen adult females (all pregnant or lactating) average: weight, 8.1 grams (6.8-9.9); total length, 120.5 mm. (113-126); tail, 45.1 mm. (40-49); hind foot, 12.7 mm. (12-13). The heaviest smoky shrew taken was a male in June weighing 10.1 grams. The heaviest female taken was nursing, with enlarged mammary glands, and weighed 9.9 grams.

BIG-TAILED SHREW

Sorex dispar Batchelder

Specimens taken. 12 (Schoharie County), in June, July, October, November and December.

Distribution and habitat. Although the big-tailed shrew is rare and local, it may be looked for wherever, within its range, there are suitable accumulations of talus on wooded mountain slopes. Rockslide areas in Schoharie County are much smaller and less developed than those of the nearby Catskill Mountains, and the most extensive ones I encountered were situated along the sides of the Schoharie Creek Valley.

All 12 specimens were taken among talus rocks along the west face of Reed Hill overlooking Schoharie Creek, at two closely adjacent localities, $1\frac{1}{2}$ and 2 miles north of Gilboa (11 specimens were taken at the first locality). This species also may occur in small areas of talus at the base of various ridges and cliffs which extend north along the valley as far as Terrace Mountain near Central Bridge in the northern part of the county. Many such areas examined, however, seemed too shallow and barren to afford suitable habitat for this species. Specimens taken on this survey are apparently the first records for Schoharie County; the species is unknown in Otsego County. Mearns (1898) and others have taken this species at Hunter Mountain in the northern Catskills of Greene County, about 20 miles southeast of Gilboa.

The habitat was similar in the two localities trapped in this study. The elevation was about 1,300 feet in both areas, with steep slopes and cliffs rising another 500 feet above the traplines to the summit of the ridge. The loose rocks of sandstone were partly covered with humus and leaf litter, and mosses and ferns were common; passages extended deeply among the rocks. The slope was rather thinly covered with a forest of paper birch (*Betula papyrifera*), black birch (*B. lenta*), other deciduous trees and scattered groups of hemlock. Mountain maple (*Acer spicatum*), growing in tall shrub form, was abundant nearly everywhere. *Sorex dispar* was taken in traps set in situations varying from on the surface in strong daylight (at entrances to deep recesses) to dark cavities about 20 inches beneath the surface.

Sorex fumeus was the commonest shrew in the rock slide habitat; in the *Sorex dispar* localities five *fumeus* were trapped for every *dispar* taken. Both of these species were frequently taken in the same trap on different days. No specimens of *Sorex cinereus* were taken in this habitat (Richmond and Grimm, 1950, in certain rock slide areas of western Pennsylvania found *cinereus* the most numerous shrew, with habits most similar to *dispar*). *Blarina* also was taken in the same rock crevices as the two species of *Sorex*. *Peromyscus leucopus* and *P. maniculatus gracilis* were both common among the rocks and over 100 of these mice were taken in the same traplines that took big-tailed shrews; red-backed mice were not so common, less than a score being trapped. Two slimy salamanders (*Plethodon glutinosus*) and a winter wren also were victims of mousetraps set in rocky recesses in this same talus area.

Food habits. Table 2 summarizes 9 stomachs examined, of which seven were from fall and two from summer. The small amount of plant material in one stomach was perhaps accidentally ingested, although this species, like other shrews, may not be averse to occasionally including some plant food in its diet. Two additional stomachs (total of 11 ex-

amed) not included in the table contained nearly 100 percent rolled oats which had been liberally sprinkled as bait near some of the traps. All specimens were taken in traps which had the treadles baited with a peanut butter-rolled oats mixture, both with and without the addition of anise oil.

TABLE 2

Stomach analyses of 9 *Sorex dispar* taken from June to November near Gilboa, N. Y.

FOOD	OCCURRENCE (NUMBER OF STOMACHS)	PERCENT OF VOLUME
Diptera (adults)	5	38.3
Orthoptera (<i>Ceuthophilus</i>)	5	17.2
Coleoptera (adults)	1	7.7
Hymenoptera (ant pupae)	1	1.1
Undetermined insects (adults and larvae, including probably at caterpillar)	2	10.6
Spiders	4	14.7
Centipedes	2	9.2
Plant material	1	1.1

Remarks. Big-tailed shrews seemed easiest to catch in autumn. Intensive trapping in their habitat in summer, 1957 and 1958 (2,985 trap nights) yielded only two specimens, and in spring, 1958 (1,505 trap nights) none; in the fall of 1957, between October 26 and December 6 (3,161 trap nights) 10 were trapped. In contrast, Richmond and Grimm (1950) found spring the best season for trapping this species and trapped almost all of their specimens then, taking only one in the fall months. In both studies, few specimens were secured in the summer months, the season in which most small mammal collecting is done; but Holloway (1957) trapped 12 specimens at Bear Cliff (elevation 4,000 feet) in Giles County, Virginia, in July. Richmond and Grimm (1950) suggest that changes in the habits of these shrews such as change in feeding behavior or increased activity associated with breeding may be important in effecting their capture.

In the present study, a drop in temperature in the fall appeared to increase the catch. For example, traps were set 1½ miles north of Gilboa on October 22, and from that date through the morning of the 25th the weather was warm (with rain), and no *Sorex dispar* were taken. Then the weather turned colder (with snow) for the period October 26

to 28 and five *dispar* were taken in that short period. From October 29 until November 5 a mild spell with rain prevailed and just one of these shrews was secured during that time. Then it turned much colder during the night of November 5 and two *dispar* were in the traps the next morning. Perhaps the low temperatures, by reducing invertebrate activity, caused more active searching for food and greater receptivity to bait on the part of the shrews. This idea is supported by the work of Fitch (1954) which indicates that seasonal differences in trapping success with many small mammals depends on the degree to which the animals are attracted to bait at different times.

The monthly distribution of the catch is as follows: June (1 adult male); July (1 immature male); October (1 adult male, 4 immature males); November (1 adult female, 1 immature male, 2 immature females); December (1 immature female). Of the 10 fall specimens, the two old adults, trapped October 28 and November 11, differed markedly in appearance from the eight immatures. The adults showed characteristics of advanced age and, being in their second autumn, were probably 14 to 18 months old. The teeth were well worn down, tails were nearly hairless and with a large portion of the tip end completely bare (tails well haired and tips penciled with long hairs in the young), and, in contrast to the immatures, the ear pinnae were bare and exposed and thus quite conspicuous, apparently due to loss of hair. The old ones were probably near the limit of their lifespan, since apparently very few adult *Sorex* survive after the end of the summer.

Reproduction. Little information was obtained relating to reproduction. An old adult male trapped on October 28 was apparently still in breeding condition (testes 4 mm. long, accessory structures large, tubules of cauda epididymis conspicuous), as probably was one on June 20 (testes 6 mm. long). The remainder of the males were immature, with testes not over 1.5 mm. long. No breeding females were taken.

Measurements. Three adults average: weight, 5.1 grams (4.5-6.0); total length, 124.3 mm. (120-128); tail, 55.7 mm. (55-57); hind foot, 13.3 mm. (13-13.5). Average measurements of nine immatures are: weight, 4.0 grams (3.5-4.5); total length 121.2 mm. (116-128); tail, 56.8 mm. (56-59); hind foot, 1.3 mm. (12.5-13.5). The heaviest specimen was the June adult male, which weighed 6.0 grams. The fall adults weighed less, the male 4.7 grams, the female 4.5 grams. All males together averaged 4.5 grams (3.8-6.0), females 4.0 grams (3.5-4.5); in other measurements the sexes were similar.

PYGMY SHREW

Microsorex hoyi thompsoni (Baird)

Specimens taken. 3 (Otsego County, 1; Schoharie County, 2).

Distribution and habitat. This tiny mammal was first taken on November 14, 1956, in Gilbert Lake State Park, and two additional specimens were secured on June 18 and July 14, 1958, on Petersburg Mountain near Cobleskill. All were trapped in tin cans sunk in the ground and partly filled with water; the cans were about 7 inches deep and $4\frac{1}{2}$ to 6 inches wide. The fact that this species was taken only in the two areas in which these cans were intensively used and that none were caught in snap traps argues that this shrew may be more common than indicated by the conventional method of small mammal collecting.

The habitats at both localities were rather similar, being open situations along the edge of woods. At Gilbert Lake the catch was made at an elevation of 1,600 feet among blackberries, raspberries and goldenrods growing along the edge between a white pine-red maple woodland and a grassy, weedy, cabin clearing. On Petersburg Mountain, the captures were made at 2,300 feet in a fire tower phone line clearing about 30 feet wide cut through sugar maple woods; here the two cans catching *Microsorex* were set (1) next to the remnant of a decayed stump, and (2) under a pile of old, rotten logs. The clearing was grown up to sedges, grasses, ferns (chiefly *Dryopteris spinulosa*), and raspberry (*Rubus* sp.). In this locality *Parascalops*, *Sorex cinereus*, *Sorex fumeus* and *Synaptomys* were taken in the same cans with *Microsorex*; the two species of *Sorex* were common in both areas where pygmy shrews were collected.

Remarks. A male trapped on June 18 was an adult apparently in breeding condition, with testes about 3 mm. long, accessory structures correspondingly large, tubules of the cauda epididymis readily visible under the low power of the binocular dissecting microscope, and side glands well-developed and conspicuous externally. Measurements of this male are: weight, 3.6 gms.; total length, 91 mm.; tail, 32.5 mm.; hind foot, 10 mm.

The other two shrews are young individuals. A male taken July 14 weighed 2.2 grams and measured 85-31-9.5; it had testes not over 1 mm. long, and the side glands were much less conspicuous than in the adult male, although internally visible as reddish oval areas on each side 5-6 mm. long. An immature female taken November 14 weighed 2.5 grams with external linear measurements 82-29-9.5.

One stomach examined contained the remains of a rather large ground beetle of the family Carabidae.

Additional specimen from Otsego County. Since the above account was written I have received from John Whitaker information regarding an individual taken by him near his home on July 3, 1958. This specimen, an immature female, was taken in an ordinary mouse snap trap about two miles north of Oneonta at an elevation of 1,700 feet. The shrew was caught at the entrance of a chipmunk-sized burrow on the edge of a grove of pines, adjacent to fields containing young pines up to 10 feet tall; the ground was heavily covered with a species of *Carex*. The stomach of the shrew held the remains of a small beetle. Measurements are as follows: weight 2.5 grams; total length, 82 mm.; tail, 29 mm.; hind foot, 9.5 mm.

SHORT-TAILED SHREW

Blarina brevicauda talpoides (Gapper)

Specimens taken. 948 (Otsego County, 449; Schoharie County, 499), in every month of the year.

Distribution and habitat. *Blarina* is one of the most abundant of small mammals and occurs in nearly all habitats. More of these shrews were trapped than any other mammal species, and only *Peromyscus* (both *leucopus* and *maniculatus* collectively) were taken as frequently. Short-tailed shrews seemed especially common in deciduous and mixed deciduous and coniferous forests where friable soil or deep leaf mold encouraged a high population of tunneling mammals, and in fields and meadows with dense grass or sedge cover such as is often favored by meadow mice. In most localities, *Blarina* usually comprised between 20 and 50 percent of the total small mammal catch; never did *Blarina* equal as much as 60 percent of the catch, and in only a few instances less than 20 percent. In one wooded area a marked decrease in the numbers of these shrews may have occurred between 1957 and 1958, as mentioned under the account of *Sorex fumeus*.

In some habitats, at least locally during the period of this investigation, *Blarina* was relatively scarce and seemed to make up only a very small percentage of the small mammal population. These habitats included certain coniferous forest areas, such as deep hemlock woods, an arbor vitae swamp (*Sorex cinereus* common) and a stand of mature red spruce, balsam fir and hemlock. On talus slopes *Blarina* was often rather uncommon and usually much outnumbered by *Sorex fumeus*, although always found to be present in this habitat. Trapping indicated that grazed upland pastures had the fewest short-tailed shrews of any habitat, probably because of the poor cover and tunneling conditions;

here *Peromyscus leucopus* was the commonest species, with *Blarina* being generally restricted in these areas to stone walls, occasional low, wet spots of denser vegetation and the like.

Short-tailed shrews were trapped in almost every conceivable terrestrial situation in the various habitats: in tunnels of *Parascalops*, *Condylura* and microtines, as well as in tunnels of their own making; in woodchuck holes; in recesses among rocks; on the outside and inside of logs and stumps; under roots of trees; at snow tunnels in winter; and in basements and at holes in the foundations of houses. On the surface of the ground these shrews were not infrequently caught in rattraps baited with meat or walnuts.

Remarks. At times these large shrews were seen running about on the surface of the ground, and occasionally their chirping voice, a high-pitched, musical "twitter," was heard. On July 4, 1957, I observed considerable activity involving two of these shrews, perhaps mating behavior. While "bird watching" from a car about an hour before sunset in an old field area where the dirt road was bordered with shady, overgrown stone walls I heard assorted chirping notes on the ground nearby. Then two short-tailed shrews were seen boldly chasing each other about in plain view over the leaves and among the rocks and bushes near a decaying wall, and only a few feet from the car. They continued to run about for a few moments, calling almost continually, and eventually in the excitement one ran out on the road and directly under the car, where it remained for a few moments. Finally the two ran together along a ditch, then separated on reaching some bushes, one running off to disappear among some rocks which had fallen from the old wall.

An entirely white albino *Blarina* with pink eyes, an adult male apparently in breeding condition, was trapped on March 29, 1957, near Cooperstown. Five others from different localities had small amounts of white in the pelage. Four shrews had the tail partly white, varying from just the tip to three-fourths of its length; one of these had the hind feet and a spot on the left side of the rump also white, while another shrew had a small patch of white-tipped hairs on its left flank.

Reproduction. Reproductive data for female short-tailed shrews are given in table 3. The December pregnancies indicate unusually late breeding for *Blarina*; another female from the same locality on December 7 had recently finished nursing. Most studies have indicated that the breeding season terminates in September or early October. However, Roslund (1951) states that occasional pregnant females are taken as late as November. Rhoads (1903) differs from other authorities in stating that young may be born at all seasons of the year, although less fre-

quently in winter, but he gave no specific instances of winter breeding. In addition to the data given in the table, 18 lactating females were taken on the following dates: May 17, 23, 24 (2), 1957; June 30, 1956; July 3, 26 (2), 1956; July 16 (2), 1957; July 5, 1958; August 2, 10, 14, 1956; September 25, 28, 1956; September 25, 1957; October 1, 1956. Twenty-one embryo and placental scar counts average 5.1 young.

TABLE 3

Reproductive data for female *Blarina brevicauda*

DATE	NUMBER AND SIZE OF EMBRYOS	NUMBER OF PLACENTAL SCARS	REMARKS
April 3, 1957			Recent parturition
April 4, 1957	4 (6 mm. crown to rump)		
April 15, 1958	5 (5 mm.)		
April 18, 1957	6 (3 mm.)		
May 2, 1958	4 (8 mm. crown to rump)		
May 8, 1958	5 (13 mm. crown to rump)		
May 22, 1958		6	Lactating
May 22, 1958		6	Lactating
May 23, 1958		6	Lactating
May 24, 1957	4 (4 mm.)		
June 19, 1958	6 (6 mm.)		
June 21, 1956	5		
June 21, 1958	6 (9 mm. crown to rump)		
July 4, 1957		3	Recent parturition; lactating
July 5, 1956	5 (3 mm.)		
July 20, 1956	5 (1 mm.)		
August 8, 1956	6 (10 mm.)		
August 8, 1956	5 (10 mm.)		
August 8, 1956	5 (12 mm.)		
August 30, 1956		6	
December 3, 1956	4 (14 mm. crown to rump)		
December 6, 1956	5 (8 mm. crown to rump)		

Measurements. Thirty-five adult females without embryos average: weight, 18.6 grams (15.5-22.7) ; total length, 124.6 mm. (116-134) ; tail, 27.1 mm. (24-32) ; hind foot, 14.3 mm. (13-16).

HAIRY-TAILED MOLE

Parascalops breweri (Bachman)

Specimens taken. 59 (Otsego County, 27; Schoharie County, 32), in every month except January, February and March.

Distribution and habitat. This is the common mole in most woodland and open habitats in the region, although outnumbered by *Condylura* in wet and mucky soils. *Parascalops* was common in such diverse situations as the sandy, alluvial soil of woods and open fields along Schoharie Creek at an altitude of 600 to 700 feet, and in the rocky humus of woodlands on the tops of the higher hills at elevations of 2,000 to 2,300 feet. About half of the specimens were trapped in woodlands of northern hardwoods (sugar maple generally common) and hemlock, where *Sorex*, *Blarina*, *Synaptomys*, *Pitymys* and other small mammals were frequently taken in the large tunnels of this mole in the humus. In five different localities, single specimens were taken in wet ground in association with *Condylura*: in a sedge meadow, in swampy woods, in weeds and thickets along streams and on the marshy fringe of a lake. Eadie (1939) found that *Parascalops* did not permanently occupy places where the soil was very wet.

In many areas where these moles occur there is often little surface "sign" to suggest their presence (although probing reveals their tunnels), but in open fields and gardens their workings are often conspicuous; these include numerous low, winding tunnel ridges several feet long and mounds of pushed-up earth. In the spring of 1958, many surface ridges were noted in gardens when they became exposed by the melting of the snow. These shallow tunnels continued to be occupied for a while after the snow left, but were later abandoned when the ground dried out.

Most of these moles were taken by snap traps placed in their tunnels; occasionally, they were secured with spear-type mole traps used when the snap traps were consistently covered with dirt and rendered useless by the activities of the moles. In the woods, several individuals were trapped on the surface of the ground next to or inside of large punky logs. Five hairy-tailed moles were caught in sunken tin cans; four of these fell into a single can set next to a large rotten log over a six-week period in midsummer.

Food habits. Thirty-five stomachs from specimens trapped during spring, summer and fall were examined. Insects, earthworms and other invertebrates made up most of the food, as summarized in table 4. Plant matter was chiefly small roots and fragments of dead leaves and stems. The single feather, as well as much of the plant matter, was probably unintentionally ingested. The principal food items are the same as those recorded by Eadie (1939).

TABLE 4

**Stomach analyses of 35 *Parascalops breweri* taken from
April to December**

FOOD	PERCENT FREQUENCY OF OCCURRENCE	PERCENT OF VOLUME
Coleoptera (adults)	51.4	13.1
Coleoptera (larvae)	48.6	13.8
Diptera (larvae)	51.4	14.8
Ants (adults)	28.6	8.1
Ants (pupae)	17.1	5.3
Lepidoptera (larvae)	5.7	.9
Hymenoptera (larvae)	5.7	.4
Unidentified insects (adults and larvae).....	48.6	10.6
Earthworms	45.7	21.3
Centipedes	31.4	6.3
Millipedes	17.1	2.6
Slugs	2.9	.6
Small feather	2.9	.1
Plant material	37.1	1.9

Reproduction. An adult female trapped on April 16, 1958, had 4 embryos measuring 16-18 mm. (crown to rump), while another taken the next day had 5 large placental scars and showed evidence of recent parturition. All the males trapped during April and May had enlarged testes about 10 to 12 mm. long, while testes length in summer and fall specimens was usually less than half this length.

Remarks. Of the 56 trapped specimens, males considerably outnumbered females: there were 36 males and 20 females. Males slightly outnumbered females in each month's catch.

Measurements. Twenty-four adult males average: weight, 51.5 grams (45.5-62.8) ; total length, 164.8 mm. (155-173) ; tail, 31.3 mm. (29-33) ; hind foot, 18.5 mm. (18-19.5). Twelve nonpregnant adult females average: weight, 45.4 grams (41.0-49.9) ; total length, 158.6 mm. (151-166) ; tail, 30.1 mm. (26-33) ; hind foot, 17.8 mm. (16-19).

STAR-NOSED MOLE

Condylura cristata cristata (Linnaeus)

Specimens taken. 21 (Otsego County, 13; Schoharie County, 8), in March, June, July, August, September and October.

Distribution and habitat. This unique mammal is common throughout the area and may be expected wherever there are low, moist situations. It seemed most numerous in the mucky soil and wet ground of open areas beside streams and ponds and in meadows, where various sedges, grasses, weeds and shrubs grew in profusion. These moles were

also taken in small, damp spots in upland fields, and in woods, both deciduous and coniferous. In woods, except in swampy places and by streams, this species is uncommon in this region, yet one specimen was taken in a relatively dry maple beech woodland on the summit of a hill where 17 hairy-tailed moles were collected.

Star-nosed moles were trapped with unbaited mousetraps set cross-wise in their tunnels, and also in surface runways which were situated beneath rank vegetation or imbedded in sphagnum. Usually no more than one or two of these moles were taken on a trapline; many traps set in their tunnels were covered by earth or new routes were established by the moles around the traps. On several occasions in summer these moles were seen crossing (or found dead on) secondary roads.

On a low golf green located between the shores of Otsego Lake and an extensive swampy area, much mole damage was seen in the winter and spring of 1957. The caretaker spoke of his annual and unsuccessful attempts to rid the premises of moles. Scores of mounds dotted the green, and star-nosed moles were taken in traps set down in tunnels 6-10 inches beneath the turf. No other species of mole was taken at this locality. Many of the mounds were old, but new mounds appeared on the bare ground here during an unusually big thaw in late January.

Food habits. Of 12 summer and fall stomachs examined, 2 were empty; of the remaining 10, all except 1 held earthworms, which in volume comprised 83 percent of the food. Remains of slugs and insects were present in several stomachs. Four stomachs contained plant remains, in three instances apparently extraneous matter accidentally ingested; however, one stomach was entirely filled with plant material, suggesting more than accidental intake; this material included rootstock of sedge (*Carex*) and unidentified stems. This stomach was from the individual trapped in the hilltop woods, as mentioned earlier, where this species seemed far removed from its usual habitat.

Reproduction. Little reproductive data was obtained for this species, since most specimens were collected outside of the spring breeding season. A male trapped on March 29 had greatly enlarged testes measuring 22 x 12 mm. The long tail of this mole becomes swollen during the winter and spring; fat stored therein may act as a temporary supply of energy useful in the breeding season (Eadie and Hamilton, 1956). An adult male trapped as early as October 23 had a notably swollen tail.

Measurements. Eleven males average: weight, 52.3 grams (42.0-58.0); total length, 196.5 mm. (183-204); tail, 77.4 mm. (71-85); hind foot, 28.2 mm. (26-34). Ten females average: weight, 46.9 grams (43.3-55.2); total length, 190.4 mm. (182-199); tail, 75.6 mm. (72-79); hind foot, 27.3 mm. (25-29).

LITTLE BROWN BAT

Myotis lucifugus lucifugus (Le Conte)

Specimens taken. 178 (Otsego County, 112; Schoharie County, 66).

Summer colonies. This is the most abundant bat of the region, and I believe it outnumbered all the other species of bats combined during the summer months. Likewise, Mearns (1898) referred to this species as the commonest bat in the Catskills. Large summer maternity colonies are to be found in buildings in both of the counties covered in this report. In early September 1956, we collected 90 little brown bats in attics of old inhabited houses in Cooperstown near the shores of Otsego Lake; these bats were chiefly adult females and immatures, but several adult males also were present. In each of three attics visited between September 4 and September 12 an estimated 40 to 60 bats were present; many bats had probably already left the summer roosts, since very few bats were found during this period in several attics which had abundant signs of occupancy. Perhaps several thousand little brown bats inhabit the village as a whole during the summer, since a large proportion of the attics have colonies. We were told that bats had been present in some of the homes continuously for at least 30 years. Large accumulations of droppings, frequently several inches, and occasionally as much as a foot deep were seen beneath favorite roosting spots.

At an old mansion near the northern end of Otsego Lake we found several little brown bats hanging behind shutters and in outbuildings; these bats were perhaps the remains of a once flourishing colony, for we were informed that hundreds had occupied the main building before the place was caulked up a few years previously. In Gilbert Lake State Park this is the common species of bat roosting in the buildings. The Old Stone Fort in the village of Schoharie has a well known summer colony which has been visited by several biologists. Benton (1958) reported on this breeding colony, and Griffin (1945) banded bats here (one bat banded September 9, 1939, was retaken March 2, 1941, in Haile's Cave, Albany County). When we collected bats here on July 29, 1957, I estimated there were perhaps 500 bats in the building.

All of our evening collecting and observations of flying bats over lakes and ponds in the more remote wooded sections as well as near villages indicated that this was the commonest bat throughout the region. This species was often observed hunting very low over the water; when noted hunting near shore in this manner they were sometimes easily captured with a long-handled insect net and a flashlight. Little brown bats also were observed at times hunting higher above the water, or in small openings between the trees near shore, and also over fields, and above

the shade trees and about the street lights in the villages. Scattered single specimens were found in summer behind shutters of cottages and in barns, while one was located behind a loose shingle of an old covered bridge. John Whitaker found two bats of this species in Benson's Cave, Schoharie County, on June 19, 1955.

Hibernation. With the approach of cold weather, little brown bats normally move into caves for the winter. In fall, these bats were seen over their hunting grounds at least as late as the end of September. In spring, an active bat of this species was seen on March 13, 1957, hanging under the eaves of a cottage near Otsego Lake; it was easily disturbed and flew away. In the northern part of Schoharie County and in neighboring counties are numerous caves which harbor these bats in winter, although apparently not often in such large concentrations as are to be found in many summer colonies. Griffin (1940) reported that as early as the middle of August in 1939 many *Myotis lucifugus* were hibernating in caves in Albany and Schoharie Counties; Mohr (1945) states that this appears to be the only such instance known for the northeastern states. In Baryte's Mine, an abandoned mine tunnel near the village of Howe's Cave, no bats could be found from July to September 1958, but a small number of hibernating bats of this species were noted hanging singly from early October through the winter. In this mine *Myotis keenii* outnumbered *M. lucifugus*, while during the winter months here *Eptesicus fuscus* also was more common than the present species.

It is generally held that bats of this species entirely desert their summer roosts in buildings with the approach of cold weather. There is a possibility that a small number may remain all winter in some buildings, although, at best, buildings must present much less satisfactory hibernating conditions than caves. On February 7, 1957, I received a fresh male specimen of this species from The Farmers' Museum in Coopers-town; it was found lying dead where it had presumably fallen from the rafters of the ceiling above (having succumbed to unsatisfactory hibernating conditions?). Repeatedly I heard assertions from owners of houses possessing summer colonies that some of the bats remain in the attics all winter, although other owners stated that as far as they knew their attics were free of bats in winter. One person mentioned seeing bats hanging in his attic at Christmas time, recalling the season because he had gone into the attic to get tree ornaments. Of course, it is possible that big brown bats, which are reported to hibernate in buildings, move into these attics in winter, although no information was obtained which would indicate that this is the case, and no big brown bats were seen in or near the *Myotis lucifugus* colonies in summer.

Measurements. Fifteen adult males average: weight, 8.8 grams (7.5-10.4); total length, 94.7 mm. (89-100); tail, 39.1 mm. (36-41); hind foot, 10.1 mm. (9.5-11); ear from notch, 16.1 mm. (15-17); forearm, 38.4 mm. (37-39.5); wingspread 268.8 mm. (257-280). Forty-eight nonpregnant adult females average: weight, 9.4 grams (7.3-11.0); total length, 96.4 mm. (92-102); tail, 39.6 mm. (35-44); hind foot, 10.5 mm. (9.5-11); ear from notch, 16.5 mm. (15-18); forearm, 38.3 mm. (36-40); wingspread, 270.3 mm. (260-282). The tragus was about 7 mm. in length in almost every specimen. Measurements given were all taken from bats collected from late July to the middle of September; a large proportion were September specimens, most of which had already accumulated considerable fat.

KEEN'S BAT

Myotis keenii septentrionalis (Trouessart)

Specimens taken. 12 (Schoharie County).

Remarks. Hamilton (1943) states that this species is far more abundant than specimens in collections would indicate and that it is rather common in New York. All our summer specimens of *Myotis*, including those collected over several ponds and lakes or found hanging singly behind shutters of cottages, were the common *M. lucifugus*. Thus I have concluded that *keenii* is undoubtedly present and probably common in summer, but that it must be considerably outnumbered by *lucifugus* in most localities.

All individuals collected came from Baryte's Mine, near the village of Howes Cave, Schoharie County, where the bats were noted on several visits to the mine between October 15, 1958, and March 24, 1959. On October 15, six *keenii* were present (all 6 were collected); on October 31, 12 of these bats were counted (1 taken); on November 10, at least 18 of these bats were present (4 taken); on January 8, diligent searching revealed only 5 of this species (1 taken); on February 7 and March 5, again only 5 could be found, while on March 24, 7 were seen. On October 31 and November 10, *keenii* was the most numerous bat in the mine, with only a small number of little brown bats, pipistrelles, and one big brown bat keeping them company. During the winter *Eptesicus* was the commonest species in the mine. It appears that the Keen's bats utilized the mine in increasing numbers during October and November, but that most of them moved on later in the season, perhaps to a larger cave. Baryte's Mine is an abandoned mine tunnel which extends for about 300 feet horizontally into the side of a hill, and it is about 61½ feet in height throughout much of its length; the mine is located at an altitude of 800 feet and its entrance overlooks Cobleskill Creek.

The Keen's bats usually were found hanging singly; sometimes two were together. They were in positions not unlike those chosen by the pipistrelles and little brown bats, chiefly hanging in or wedged in cracks in the ceiling, but occasionally hanging on the wall; one was found wedged in a small drill hole only two feet above the floor. These bats were rather well distributed throughout the mine, being found from near the entrance in deep cracks to the warmer, more humid rear of the mine. The walls and ceiling of the mine were wet, and as the season progressed some of these bats became silvery with glistening droplets of water on their fur. Two wedged together in a crack in the ceiling apparently did not change their positions between January 8 and March 24.

Measurements. Four adult males average: weight, 8.0 grams (7.3-8.9); total length, 94.3 mm. (92-98); tail, 41.3 mm. (38-44); hind foot, 9.0 mm. (8.5-9.5); ear from notch, 18.5 mm. (18-19); tragus, 9.0 mm. (8-9.5); forearm, 35.8 mm. (34-38); wingspread, 252.5 mm. (247-260). Three adult females average: weight, 8.5 grams (7.0-9.6); total length, 94.0 mm. (93-96); hind foot, 9.8 mm. (9-11); ear from notch, 18.7 mm. (18-19); tragus, 9.0 mm. (9); forearm, 36.3 mm. (35.5-37); wingspread, 256.3 mm. (250-263).

EASTERN PIPISTRELLE

Pipistrellus subflavus obscurus Miller

Specimens taken. 4 (Otsego County, 1; Schoharie County, 3).

Remarks. Pipistrelles are probably rather generally distributed, although not abundant, in the region. Only one was collected in summer, a male found September 7, 1956, hanging from the ceiling of a small abandoned outbuilding adjacent to a small wooded ravine near Otsego Lake. Other buildings nearby were inhabited by several *Myotis lucifugus*. In winter, pipistrelles occur regularly in small numbers in the caves of Schoharie County and adjacent areas. In October 1958, three hibernating males hanging singly were collected in Baryte's Mine; none were seen here on several visits from July to September. John Whitaker collected three in Baryte's Mine on November 24, 1956, and two in McMillen Cavern on May 28, 1955; he also recorded the species as present in Mitchell's Cave, in Montgomery County just north of this region, on December 5, 1954.

Measurements. Four males average: weight, 7.5 grams (6.1-8.7); total length, 86.3 mm. (84-89); tail, 39.5 mm. (39-41); hind foot, 9.6 mm. (9-10); ear from notch, 14.8 mm. (14-15); forearm, 34.0 mm. (32.5-35.5); wingspread, 245.5 mm. (239-250).

BIG BROWN BAT

Eptesicus fuscus fuscus (Palisot de Beauvois)

Specimens taken. 32 (Otsego County, 2; Schoharie County, 30).

Remarks. During the warmer months a small number of these bats were collected or observed in flight, but no large summer concentrations were found. All summer bat colonies investigated were composed exclusively of individuals of *Myotis lucifugus*. Mearns (1898) stated that *Eptesicus* was common (region of Kaaterskill Junction, Catskill Mountains), while Merriam (1884) in speaking of the Adirondacks referred to this species as "unquestionably the rarest bat found within the limits of the region."

During winter this is one of the common bats occurring in caves in Schoharie County. *Eptesicus* remains active later in the fall than most other bats. In Baryte's Mine (described under the account of Keen's bat) in the fall of 1958 I saw none of this species until November 10, when one was present along with about two dozen *Myotis*. But between 20 and 30 *Eptesicus* were counted on each visit to the mine during January, February and March, when they outnumbered the smaller bats. A few *Eptesicus* were on walls at the rear of the mine, but the majority were near the entrance (on walls or in crevices) where the temperature was lower and the walls drier than at the back of the mine; some were hanging in strong daylight where there was a layer of ice on the floor of the mine. Most of these bats were single, but one compact bunch of 6 was observed on February 7 in a shallow concavity in the wall near the entrance, and this cluster increased in size until it consisted of 11 bats on March 24. There was evidence of considerable shifting about by big brown bats in the mine in winter.

Measurements. Two adult males average: weight, 20.5 grams, (19.9-21.1); total length, 115.0 mm. (112-115); tail, 44.0 mm. (43-45); hind foot, 11.3 mm. (10.5-12); ear from notch, 17.5 mm. (17-18); tragus, 7.5 mm. (7-8); forearm, 45.5 mm. (45-46); wingspread, 319.5 mm. (318-321).

RED BAT

Lasiurus borealis borealis (Müller)

Specimens taken. 2 (Schoharie County).

Remarks. The status of the red bat in this region is uncertain. One was shot by Donald Miller at 9.30 p.m., E.D.T., on June 24, 1957, over a small pond 1½ miles southwest of Hyndsville, where a hoary bat and little brown bats also were collected. Another was found dead in a

mumified condition in a barnyard 1 mile west of Cobleskill in August 1957. Probably red bats are much more common than these two records suggest. However, we made only a few probable sight observations of this species and never were red bats in this region seen flying about early in the evening or during daylight hours as they are accustomed to do. It has been recorded from all sides of this region, although Merriam (1884) states that it is among the least common bats in the Adirondack region.

HOARY BAT

Lasiurus cinereus cinereus (Palisot de Beauvois)

Specimens taken. 1 (Schoharie County).

Remarks. On July 24, 1958, at 9:15 p.m., E.D.T. (late twilight), the author shot an adult female hoary bat over a small pond $1\frac{1}{2}$ miles southwest of Hyndsville. Additional observations of hoary bats were made at this locality but no others were collected. The pond, about $4\frac{1}{2}$ acres in extent, and known locally as Old Pond, is situated at an altitude of 1,720 feet in hilly country where there is much abandoned farmland. The pond is bordered chiefly by dry fields, only a fourth of the shoreline being bordered by mixed deciduous woods, but the woods are continuous with a nearby wooded slope. Probably in this region, as well as in many other parts of the country, this large bat is more common than the scanty records would indicate. In one season, A. K. Fisher, W. H. Merriam and C. H. Merriam shot 19 specimens in and near the western border of the Adirondacks (Merriam, 1884), although Merriam states that scarcely a suitable evening passed during the entire season that was not devoted to bat hunting. If this species came out earlier during the summer evenings, undoubtedly more would be taken and we would then have a better knowledge of its distribution at this time of the year.

The bat which was shot was not solitary, but was in company with one, and possibly two of its kind; one of these was also believed to have been hit but it was not recovered. Hoary bats were seen at Old Pond several times during August, but the species was not definitely recorded after the end of the month. Usually the hoary bats were first seen 15 to 20 minutes after the first little brown bats (*Myotis lucifugus*) were noted, and they could be seen for only a few minutes. On several nights I did not see them at all, probably because they did not fly about until after it was too dark for me to detect them. On two evenings hoary bats were first seen flying swiftly along parallel and close to the shore, no more than three feet above the water; they passed close to me but disappeared

quickly into the gloom. Occasionally two were seen momentarily against the fading western sky flying together above the pond about on a level with the tops of the trees. The manner of flight as I observed it was always powerful, swift and direct, and not at all erratic; in this respect agreeing with the flight description given by Provost and Kirkpatrick (1952). The long, narrow, pointed wings, and usually the large size, also were distinctive in flight.

When shot, the bat fell into the water, but being merely wounded in a wing swam swiftly to shore. When I approached to pick it up, the bat opened its mouth wide in a threatening manner, and baring large teeth, uttered rasping screeches, much louder and harsher than the cries of *Myotis*.

Food habits. The stomach of the single specimen collected was distended with insects of the orders Neuroptera, Coleoptera, Hemiptera, Diptera and Orthoptera. Numerous wings of two or more species of small plant bugs of the family Miridae were present, including probably the common garden pest, *Lygus pratensis*.

Reproduction. All four nipples showed evidence of recent nursing, while there seemed to be two faint placental scars, one in each horn of the uterus (two young, born sometime in June, is usual in this species). On July 1, 1953, at Syracuse, N. Y., Stegeman (1955) obtained a freshly killed hoary bat with two well-grown young.

Measurements. Measurements of the single specimen are as follows: weight, 26.8 grams; total length, 144 mm.; tail, 59 mm.; hind foot, 11 mm.; ear from notch, 20 mm.; forearm, 55 mm.; wingspread, 412 mm.

EASTERN COTTONTAIL

Sylvilagus floridanus mearnsii (J. A. Allen)

Specimens taken. 16 (Otsego County, 5; Schoharie County, 11).

Distribution and habitat. This is the common rabbit throughout these counties, occurring at all altitudes; several specimens were collected on the tops of the higher hills at elevations of 2,000 to 2,300 feet. Cottontails are not restricted in habitat, and were not found to be altogether absent in any of the major habitats covered in this survey. In general, the presence of herbaceous and shrubby vegetation affords good habitat for this species. Specimens were taken in deciduous woods of maple and beech, and where hemlock or spruce predominated, as well as in more open situations.

Food habits. During the summer, cottontails eat green grass and other low herbaceous vegetation, but in winter rely heavily on twigs and bark of woody plants. During winter, when there was considerable snow on the ground, plants observed to be heavily browsed by this species included staghorn sumac (*Rhus typhina*) (bark of young stems), hemlock (bark of twigs), silky osier (*Cornus ammomum*) (chiefly stems and branches less than $\frac{1}{4}$ inch in diameter), and canes of raspberry and blackberry; at this season rabbits also were noted to be feeding on sprouts growing from the base of apple and of hornbeam (*Carpinus caroliniana*), canes of rose, young stems of mountain maple (*Acer spicatum*) and striped maple (*A. pennsylvanicum*), and twigs of beech and basswood. During the deep snow of early 1958, cottontails came nightly into the yards of our headquarters and other houses in residential Richmondville to feed on cultivated roses and other shrubs.

Measurements. Four males taken in winter average: weight 1,275 grams (1,201-1,347); total length, 458.3 mm. (448-477); tail, 54.5 mm. (45-68); hind foot, 102.0 mm. (100-105); ear from notch, 65.8 mm. (65-67). Four females taken in winter average: weight, 1,184 grams (1,006-1,370); total length, 472.0 mm. (455-480); tail, 69.8 mm. (60-88); hind foot, 101.3 mm. (96-107); ear from notch, 63.0 mm. (all 63).

NEW ENGLAND COTTONTAIL

Sylvilagus transitionalis (Bangs)

Remarks. In this survey, rabbit collecting was limited and no specimens of *transitionalis* were taken. I do not know what the status of this species is in the region, except that it is apparently much outnumbered by *floridanus*. Probably it is not uncommon in wooded sections at higher elevations in some areas, but *floridanus* was the only species we took in such situations. Dr. Allen H. Benton informs me that there is a female New England cottontail in the collection of the State University College of Education at Albany which was taken by Richard Herodes on December 25, 1957, at Warnerville, Schoharie County. Mearns (1898) recorded this species from the upper Schoharie Creek Valley to the south of this region in the Catskill Mountains of Greene County.

EASTERN CHIPMUNK

Tamias striatus lysteri (Richardson)

Specimens taken. 138 (Otsego County, 70; Schoharie County, 68), in every month except December and January.

Distribution and habitat. Chipmunks appeared to be common in woodland and woodland edge habitats everywhere in Otsego and Schoharie Counties during this study. Most woodland areas seemed to have their share of these rodents, including various types of deciduous and coniferous woods. In the fall of 1956, chipmunks were observed to be particularly abundant in a beech and sugar maple forest where other trees were scarce; here there was an abundance of beechnuts and maple seeds on the ground on which the chipmunks were feeding. In some stands of red spruce where red squirrels were abundant, chipmunks also seemed to be everywhere. This species was also found living on wooded talus slopes and in ravines, along rocky fence rows where there were scattered trees, and in brushy second-growth woods. Specimens were trapped under buildings in suburban as well as woodland areas.

Food habits. The following foods were recorded, based on field observations and the contents of 31 stomachs and the cheek pouches of 16 individuals. Seeds or nuts were present in most of the stomachs, but usually were not specifically identifiable. Beechnuts, and seeds of maple, hornbeam (*Carpinus caroliniana*) and Canada mayflower (*Maianthemum canadense*) were found in the cheek pouches of chipmunks. The seeds of hornbeam are at times eaten in large quantities, to judge from animals observed feeding and the remains found on the tops of stumps; also pieces of the leafy bracts were recognized in the stomachs. In September and October nine chipmunks trapped had maple seeds (with the wing clipped off) in their cheek pouches; these were chiefly seeds of sugar maple, in one instance I believe striped maple. In one area, sign was noted where chipmunks had evidently been feeding on beaked hazelnuts (*Corylus cornuta*). Raspberries, blackberries and nannyberries (*Viburnum lentago*) were present in some of the stomachs; one individual had its cheek pouches crammed with nannyberries. Animal food of various types is relished by chipmunks. Insects (adults and larvae) were present in 10 stomachs, while slugs were found in two stomachs and a snail (*Anguispira alternata*) was collected from the cheek pouch of 1 individual. One chipmunk had its stomach and cheek pouches distended with pieces of young red-backed mice.

Hibernation. Chipmunks become dormant in winter, but usually not for so long a period as the more profound hibernators such as wood-

chucks and jumping mice, and individuals are occasionally up and about during mild spells in winter. In the fall of 1956 chipmunks were much in evidence all through October and the first few days of November; after that they were less often seen or heard, and the last one was trapped on November 22. In 1958 one was observed regularly in our yard at Richmondville up until November 21, after which it disappeared; on March 5 a chipmunk, probably the same individual, was again active in the yard. The earliest record in 1957 was February 15; after that date a few were regularly seen during the latter part of the month, as well as in March and April. In the spring of 1958 no chipmunks were recorded until April 23; quite likely the deep snow cover which lingered on into spring that year had much to do with delaying their emergence, although probably some chipmunks were about before I recorded the species.

Remarks. Reports were received of one or more "pure white" chipmunks in the vicinity of Van Hornesville near the northern border of Otsego County; if true, this would be of interest in view of the fact that Allen (1938) finds no record of albino chipmunks, which are evidently uncommon.

Fifteen chipmunks trapped from August 1 to October 3 each had one or two *Cuterebra* (botfly) larvae, or scars indicating the recent presence of these parasites; most of these larvae were located in the inguinal and belly region.

Reproduction. There are two breeding periods in the eastern chipmunk, with young being born in spring or in midsummer (Yerger, 1955). Three gravid females were taken, as follows: March 28, 1957, 7 embryos at 22-25 mm. crown to rump; July 12, 1956, 4 embryos at 12 mm.; July 18, 1956, 7 embryos at 3.5 mm. Five placental scar counts are as follows: April 3, 1957, 4 scars and lactating; August 16, 1957, 5 scars; August 31, 1956, 5 scars; September 9, 1958, 4 scars and lactating; September 11, 1958, 5 scars and lactating. The earliest male taken (February 15) was evidently already in breeding condition, with testes enlarged and descended. Several small young, newly out of the nest, were seen along the roads as early as the last week in April, 1957; probably these were born in the latter part of March.

Measurements. Thirty adult males average: weight, 92.8 grams (81.1-108.7); total length, 246.3 mm. (227-263); tail, 94.2 mm. (83-108); hind foot, 24.6 mm. (32-37). Twenty-four adult females without embryos average: weight, 85.9 grams (71.2-104.7); total length, 244.4 mm. (231-259); tail, 94.8 mm. (87-105); hind foot, 34.5 mm. (33-36).

GRAY SQUIRREL

Sciurus carolinensis pennsylvanicus Ord

Specimens taken. 13 (Otsego County, 9; Schoharie County, 4).

Distribution and habitat. Gray squirrels are common and generally distributed in this region, occurring on the higher hills, in the valleys and about the villages. Most numerous in the heavily wooded sections, they were frequently observed in the forests of northern hardwoods with varying admixtures of hemlock, as well as in woods predominately oak.

Remarks. During 1957 gray squirrels were believed to be especially abundant, at least in Schoharie County, when they seemed to be everywhere along the roads. In the same year the district game manager reported records of extremely high populations for many areas in the Catskill District, which includes Schoharie County (Anon., 1957). The spectacular gray squirrel emigrations of early days and the smaller ones of recent times, in which large lakes and rivers may be crossed, are well documented. Heacox and Hall (1958) report that in the summer of 1957 gray squirrels in large numbers swam east to west across Schoharie Reservoir, which is located in the extreme southern part of Schoharie County and in adjacent Greene and Delaware Counties; many squirrels drowned in the attempt (on September 6 and 7, 88 drowned squirrels were picked up by water supply employees).

However, gray squirrels were not seen in many areas in which red squirrels were common, and in most localities there were probably fewer of the former than the smaller red and flying squirrels. But frequently we observed gray squirrels living together in the same woods with red and flying squirrels, even though several instances of reds pursuing grays were noted.

In winter, gray squirrel activity is reduced during periods of deep snow and low temperatures. Even then they may be about searching for food, however, and these animals were seen abroad several times when the temperature stood at about 0° F. and once during a blizzard. Occasionally they were observed to strike out across deep snow in open country, probably to reach isolated feeding areas, during periods of severe weather when the reds remained in their nests or ventured out only briefly in small areas of dense cover.

No black squirrels, melanistic individuals of this species which are found in some parts of the State, were seen.

Reproduction. Litters of gray squirrels are brought forth in early spring and again in summer, in two annual breeding seasons. One collected February 5, 1957, in Otsego County, had seven 6 mm. embryos. A lactating female was taken July 13, 1956.

Measurements. Eight adults average: weight, 599.9 grams (520.2-724.5) ; total length, 490.0 mm. (462-534) ; tail, 230.1 mm. (187-249) ; hind foot, 67.6 mm. (61-71).

RED SQUIRREL

Tamiasciurus hudsonicus loquax (Bangs)

Specimens taken. 75 (Otsego County, 36; Schoharie County, 39), in every month of the year.

Distribution and habitat. Coniferous woods, mixed stands of conifers and deciduous trees, and to a lesser extent purely deciduous forests all support red squirrels. Stands of red spruce or red spruce mixed with balsam and/or hemlock, although rather limited in this region, usually had many red squirrels, with numerous cone middens and burrows attesting to their abundance in such habitats; here, too, the squirrels themselves were usually to be seen and heard. In one Otsego County locality in late winter, 1957, a high population was encountered in an arbor vitae swamp and adjacent brushy woods of thornapple (*Crataegus*), apple, nannyberry, staghorn sumach, wild grape etc.; here their burrows and well-worn trails were everywhere in the snow, and 15 of these squirrels were taken in a dozen rattraps set for a two-week period in an area of about an acre in size.

Woods of sugar maple, beech, yellow birch and hemlock were usually inhabited by red squirrels, although here the animals did not seem to attain the high numbers as exemplified by the habitats mentioned above. Red squirrels were also observed and trapped in woods of sugar maple and beech, red maple and oaks, beneath birches on talus slopes, and under conifers along the edge of plantations and in cemeteries. Barns and deserted buildings in rural areas showed evidence of considerable use by red squirrels. Gray squirrels, flying squirrels and chipmunks were all observed living alongside red squirrels in the same habitats.

Food habits. Red squirrels consume many seeds of coniferous trees, and we often noted where they had been feeding on the cones of white pine, red spruce and hemlock. In some stands of mature red spruce in Schoharie County nearly every large tree had at its base a large pile of scales of the husked cones. Hemlock, because of its more general distribution in the region, is probably the most important conifer both as regards food and shelter. In plantations, cones of Scotch pine (*Pinus sylvestris*) and white spruce (*Picea glauca*) were utilized. In an arbor vitae swamp where the squirrels were plentiful, limited use of the seeds of arbor vitae was indicated. Acorns of red and white oaks, butternuts, shagbark hickory nuts, and fruits of apple, thornapple (*Crataegus*) and

nannyberry (*Viburnum lentago*), were observed to be eaten extensively. Late in the winter of 1957-58 much girdling of staghorn sumac was in evidence; the bark was still being consumed by red squirrels at least as late as the end of March. On April 23, 1958, a red squirrel was observed in a large staghorn sumac, feeding on the fruit. In a cemetery in February 1958, the ground in many places was littered with twigs of white spruce with buds eaten out. Such food as acorns, nannyberries, blueberries and even small puffballs were found buried in small pits in the ground.

Twenty-two stomachs from various months were examined. Mast and seeds were noted in 13 stomachs; fungi, including mushrooms, in 5; green plant matter, including buds, in 4; fruit of thornapple in 3; raspberries in 2; and apple, including probably bait, in 7.

Remarks. Red squirrels were noted to be active in the snow in temperatures as low as -5° F., but seemed to be limited in their activity or confined to thick coniferous cover during severe weather. Red squirrel diggings in the snow were often seen, including tunnels and trails from tree to tree and vertical burrows connecting with their burrows and stores in the ground.

In February, two red squirrels were trapped on successive days at a woodchuck hole. Judging from the position of the squirrels in the trap, they were emerging from the hole when caught.

Several reports were received from local residents in Otsego County of "pure white albino" red squirrels being observed or killed near Oneonta and Mount Vision. We saw none of these, but two of the squirrels collected showed a small amount of white spotting. A female had the toes of the hind feet white, and the claws of the toes were also without pigment. A male had a patch of white hairs on the dorsal surface of the tail near its base, with a few scattered white hairs on the rump.

Reproduction. There are two breeding seasons in the red squirrel, most of the young being born in early spring or in summer (Hamilton, 1939; Layne, 1954). No pregnant females were taken in this study, but lactating individuals were captured from March 31 to November 21; number of placental scars ranged from 4 to 6. The November 21 lactation date is, I believe, late for the species, October being the usual termination of the breeding season; Layne (1954) obtained lactating females as late as October 19, while Hamilton (1943) has found nest young in late October in New York. Milk could be expressed from all 8 nipples of this late-nursing female (mammary tissue in two sheets 3-4 mm. thick, weighing about 16.3 grams), and there were 6 distinct placental scars.

Measurements. Twenty adult females average: weight 198.9 grams (175.5-236.5); total length, 324.6 mm. (310-349); tail, 128.4 mm. (113-140); hind foot, 48.1 mm. (46-51). Sixteen nonpregnant adult females average: weight, 195.5 grams (176.1-221.6); total length, 315.4 mm. (304-327); tail, 126.3 mm. (108-139); hind foot, 47.1 mm. (45-49).

SOUTHERN FLYING SQUIRREL

Glaucomys volans volans (Linnaeus)

Specimens taken. 29 (Otsego County, 14; Schoharie County, 15), in every month except January, March and September.

Distribution and habitat. The small southern flying squirrel occurs throughout these counties, but at higher elevations is probably outnumbered by the northern flying squirrel. *G. volans* was common in various kinds of woodland, and it was trapped in woods of sugar maple and beech with varying percentages of hemlock and also in woods composed chiefly of red oak and white oak. In two localities in December a total of 11 were trapped in stands of mature hemlock, where their tracks were numerous in the snow. Perhaps winter activity is concentrated in the shelter of conifers; tracks of this species and *sabrinus* at this season seemed most numerous under hemlock, white pine and other conifers.

Most of the Otsego County specimens were trapped on the wooded slopes and hills about Otsego Lake, where this species seemed to be common. Rather intensive trapping in Gilbert Lake State Park in 1956, however, produced only two flying squirrels (*sabrinus*); yet woodcutters here spoke of occasionally seeing large groups of flying squirrels emerge from trees being felled. Perhaps our trapping was done during a period of low abundance in the area, unless some difference in their habits here made trapping more difficult.

Food habits. Fifteen stomachs have been examined, from specimens taken from February to October. Plant food accounted for 78.3 percent of the total volume. This was chiefly unidentified mast and fungi; foliose lichens (August, 1 stomach), green buds (April and May, 2 stomachs), and apple bait (April, 1 stomach) also were recognized. Animal food (21.7 percent by volume) occurred in 6 stomachs and consisted of insects and other invertebrates (including beetles and probably slugs). In November, tracks and husked cones on top of a log showed where a flying squirrel had been eating seeds of hemlock; a rattrap set on the log secured one of this species.

Remarks. In February, the head of a squirrel of this species was found in the stomach of a screech owl found lying dead on the snow in a

pasture; two days later the headless remains of one of these squirrels, perhaps the same individual, was found under a hemlock in an adjacent woodlot.

Several individuals of both species of flying squirrel were heavily infested with mites, fleas and lice.

Reproduction. Females carrying 2 to 7 embryos were trapped during spring and summer, as follows: April 6, 1958, 4 embryos (2 mm.); April 24, 1958, 2 embryos (14 mm. crown to rump); June 26, 1958, lactating; June 31, 1956, 7 embryos (12 mm. crown to rump); August 2, 1956, 6 embryos (23-26 mm. crown to rump).

The sex ratio of 26 specimens was 50:50.

Measurements. Ten adult females average: weight, 69.0 grams (62.9-81.9); total length, 237.4 mm. (232-247); tail, 107.6 mm. (101-115); hind foot, 30.8 mm. (29-33); ear from notch, 20.7 mm. (20-22). Six adult females without embryos average: 72.3 grams (65.5-78.1); total length, 243.3 mm. (237-250); tail, 103.0 mm. (106-118); hind foot, 30.7 mm. (29-32); ear from notch, 21.2 mm. (20-23).

NORTHERN FLYING SQUIRREL

Glaucomys sabrinus macrotis (Mearns)

Specimens taken. 37 (Otsego County, 4; Schoharie County, 33), in every month except December.

Distribution and habitat. The northern flying squirrel in this part of New York is as widely distributed as the better known southern species. Specimens were collected at widely separated localities in the two counties, although it appeared to be most numerous on wooded slopes in the central and southern part of Schoharie County. On several trap-lines in this area more of these animals were taken than any other species of squirrel, and in deep woods at higher elevations in general it may frequently be the commonest sciurid. *Glaucomys sabrinus* was trapped at elevations ranging from about 1,000 to 2,300 feet; *G. volans* also was trapped throughout this altitudinal range, but, whereas half (18) of the *sabrinus* collected were caught at approximately 2,000 feet or above, only three *volans* were taken this high, over two-thirds (19) of this species taken being trapped at an altitude of 1,450 feet or lower.

However, there seems to be no outstanding difference in the habitat preference of the two species of *Glaucomys* in this region. Both were taken in deciduous woods, in mixed woods with much hemlock, and in stands of conifers. Optimum habitat for *G. sabrinus* appeared to be woods composed of such trees as beech, sugar maple, red oak, various

birches and other deciduous trees, with an admixture of hemlock or other conifers, such as white pine. Half a dozen specimens were collected in a woods of nearly pure sugar maple and beech, without conifers. Northern flying squirrels also were taken in dark stands of red spruce, balsam fir and hemlock. Specimens were trapped on steep talus slopes beneath rather open growths of paper birch, black birch, mountain maple and hemlock, where their tracks were numerous on snow-covered rocks in winter.

Although there is probably complete overlap in the altitudinal distribution of the two species of flying squirrel in the limited altitudinal range present in this region, there seems to be some degree of segregation in the two species, in that one woodland may be occupied by only one of the species while a similar woodland nearby may be inhabited by the other. On occasion, however, both are trapped in the same woods: in three instances single specimens of *volans* were collected in woods where two or more *sabrinus* were taken, and in one of these instances both species were trapped on the same log. Trapping a series of five localities along the valley of the West Kill and adjacent Burnt Hill in Schoharie County demonstrated the way the two species may overlap in one general area, seemingly without respect to type of woods, and also how in this survey usually only one species was taken in the relatively small area covered by a trapline: (1) 1 mile northwest of North Blenheim, elevation 1,050 feet, valley of West Kill, 5 *volans* were taken in a stand of large hemlocks; (2) 1 mile upstream, elevation 1,060 feet, 7 *sabrinus* were taken in woods of hemlock, white pine, red oak, white oak, and sugar maple; (3) 1 mile farther upstream, at Betty Brook, elevation 1,300 feet, 3 *sabrinus* were taken under hemlock and white pine growing among yellow and paper birches, beech, and oaks; (4) one-third of a mile north, on Burnt Hill, elevation 1,400 feet, 4 *volans* were taken in woods of white pine and red maple; (5) 1 mile northwest of last locality, on Burnt Hill, elevation 1,960 feet, 1 *volans* and 2 *sabrinus* were taken in sugar maple and beech.

Red squirrels, gray squirrels and chipmunks were often common in the same woods where the nocturnal flying squirrels were trapped.

Food habits. Stomachs representing all months of the year except August and December were examined (table 5). The contents of 7 summer stomachs (June 1 to September 12) were composed almost entirely of mast and unidentified fungi, including mushrooms. Husked hemlock cones at the base of trees probably often represented the work of these squirrels. Of 8 spring stomachs (April 22 to May 29) all except 1 contained green buds, which constituted over a third of the volume; some mast, including seeds of black birch (*Betula lenta*) in 1 stomach,

fungi, bark, and animal remains were also included. Ten of the 15 winter stomachs (January 24 to March 27) held green plant material, which accounted for about a third of the volume. Two animals trapped on January 24 had large stomachs crammed with the winter buds of hemlock; many small hemlock twigs and needles noted on the ground in some areas may have indicated feeding by these animals on the buds. Two stomachs in February and March contained an abundance of staminate catkins, apparently of yellow birch (*B. lenta*); near where these specimens were trapped the ground under a yellow birch was strewn with twigs and catkins, and some of the latter were partly eaten (in another area many yellow birch seed clusters on the ground were thought to have been cut down by these squirrels). Four specimens taken in one area on March 19 and 20 contained many catkins of speckled alder (*Alnus rugosa*), which was growing abundantly in a moist hillside opening near where the squirrels were trapped. A food which amounted to less than a tenth of the volume of winter food but which was found in 7 out of 8 stomachs from one area in March was foliose lichens with bits of bark; probably the lichens, common on elm, maple, and birch in area trapped, were intentionally eaten by the squirrels, the bark being accidentally ingested in the process. Mast, undetermined fungi and animal remains were also represented in winter stomachs.

TABLE 5

Stomach analyses of 32 *Glaucomys sabrinus* taken throughout the year

FOOD	PERCENT FREQUENCY OF OCCURRENCE	PERCENT OF VOLUME
Mast	37.5	25.3
Fungi	40.6	23.9
Green plant matter (chiefly buds, catkins)	59.4	23.7
Lichens and bark	28.1	3.7
Vertebrates (small birds and mammals)	9.4	3.4
Invertebrates (insects and probably slugs)	18.8	2.3
Unidentified plant matter	12.5	2.7
Apple bait	34.4	15.0

Remarks. Most of the flying squirrels were collected with rat snap traps placed on the ground at the base of large trees or on the tops of logs and fallen trees, and baited with apples, walnuts or dead mice. Apple proved to be the most convenient bait to use and seemed to attract flying squirrels at least as much as the other baits.

During the deep snow of January, February and March 1958 (snow 20 to 32 inches deep in the woods), 16 northern flying squirrels were

taken on three different Schoharie County traplines in traps set at the base of trees or in the space beneath fallen trees. With deep snow accumulated on the tops of stumps and logs, these objects were no longer used as feeding spots or highways of travel by the squirrels, but numerous tracks showed where these animals ran about beneath the shelter of small hemlocks and other conifers in the woods, or where the animals traveled across the snow from tree to tree. In one of these areas in late January, with the snow about 2 feet deep, numerous tracks of this species criss-crossed the snow beneath a group of about a dozen small, young hemlocks 15 to 25 feet in height; the surrounding woods were predominantly beech. Four traps placed here secured 3 adult female and 3 adult male *G. sabrinus*.

Besides the tracks, the tunnels and burrows of the animals also were to be seen in the snow. The tracks showed where they investigated natural cavities in the snow at the base of trees and where the lower branches of the hemlocks were buried under the snow; the squirrels often enlarged these cavities by tunneling vertically downward, perhaps to search for food on the ground. At this same place on January 30 the rattraps were found to be covered with 10 inches of fresh snow; above two of the traps, set at the base of trees, were vertical snow tunnels made by flying squirrels to get at the apple bait which I had placed on and near the traps. One individual had tunneled down to the bait and was caught by a snow-covered trap. Nearby, another tunnel showed where this or another flying squirrel had burrowed down to get pieces of apple placed near another trap, but the animal did not get caught in the trap. Here the squirrel brought pieces of apple to the surface of the snow, and ate them just outside the burrow, leaving pieces of apple skin on the snow. At this same location there was also a large log sufficiently elevated above the ground to permit the formation of a space beneath it which was banked with snow along the sides, but judging from the tracks beneath the log frequently traveled by flying squirrels. In several spots where the snow had drifted beneath the log, blocking the passage, the animals tunneled straight through; these horizontal tunnels somewhat resembled weasel tunnels in the snow. Two *G. sabrinus* were taken in a trap set under this log.

None were taken on windy winter nights, but temperature alone does not seem to limit the activity of northern flying squirrels and they were active on the snow at temperatures at least as low as -10° F. One was trapped in a night of heavy, I believe continuous rain, although no other captures were made on rainy nights.

Owls are numbered among the deadliest enemies of flying squirrels. An owl pellet, probably from a great horned owl, found beneath a tree

near Cobleskill contained the skull and hair of *Glaucomys sabrinus*. A cat killed one of these squirrels in Gilbert Lake State Park while we were there.

Two adult males from the same locality in Schoharie County in March 1958, had small areas of white fur and probably were cases of white spotting. One had a patch of white hairs on the left shoulder region, the other a patch of white hairs on the back, near the base of the tail.

Several more males than females were taken; of 37 trapped individuals, 21 were males and 16 were females.

Reproduction. Females with 2 to 5 embryos or placental scars were trapped, as follows: April 22, 1958, 2 embryos (24 mm. crown to rump); May 25, 1957, lactating, with 5(?) placental scars; May 27, 1958, lactating, with 5 placental scars; September 12, 1958, lactating, placental scars present.

Measurements. Seventeen adult males average: weight, 99.2 grams (80.7-111.0); total length, 272.9 mm. (264-284); tail, 122.9 mm. (115-132); hind foot 36.3 mm. (34-39); ear from notch, 23.6 mm. (22-25). Thirteen adult females without embryos average: weight, 101.0 grams (76.5-125.0); total length 276.2 mm. (260-293); tail, 124.1 mm. (116-134); hind foot, 36.8 mm. (34-39); ear from notch, 23.5 mm. (22-25).

DEER MOUSE

Peromyscus maniculatus gracilis (LeConte)

Specimens taken. 451 (Otsego County, 192; Schoharie County, 259), in every month of the year.

Distribution and habitat. The graceful, soft-furred deer mouse is common in this part of New York, being found nearly everywhere in the woods of sugar maple, beech and hemlock (and other forest types) covering much of the hilly upland country. This was found to be the common species of *Peromyscus* in woods in Gilbert Lake State Park, in many ravines and wooded hills about Otsego Lake and Cooperstown, in woods over large areas of Burnt Hill and of other hills in the central and southern part of Schoharie County and in other areas.

At lower elevations *leucopus* outnumbers this species, but *maniculatus* was taken as low as 1,050 feet in a hemlock woods, and, in a cool wooded ravine at an elevation of only 1,300 feet, the catch of this species outnumbered *leucopus* by 17 to 1. Above about 1,000 feet there is a broad area of overlap with *leucopus*, extending to the highest elevations trapped, as mentioned under the account of that species. Sometimes, without any reason apparent to me, one species would be dominant in one area

while the other species would be dominant in a different but similar appearing area. But an examination of the trapping records shows that *maniculatus* was usually the common species in the more mature woodlands at and above about 1,600 feet (also was dominant on five traplines in cool woods and ravines between 1,300 and 1,450 feet). Where the two species occurred together, they were often taken about the same logs and stumps or in the same rocky recesses, although some tendency to segregation also was apparent. *P. maniculatus* did not, in the region under consideration, show consistent affinity for certain seemingly "northern" habitats such as shaded talus slopes and deep woods of spruce and hemlock; *leucopus* was just as apt to be taken in such areas, and sometimes was the common species in these habitats at medium and even at the higher elevations.

In general, this species may be said to be less flexible in regard to habitat in comparison with *leucopus*. Very few were trapped far from the shade of the forest trees. They occasionally venture out into the open, marshy fringe of lakes in wooded areas. A small number, less than a dozen altogether, were taken in old fields and other open habitats where white-footed mice also were taken. Abandoned cabins and shacks in the woods were often found to be occupied by these mice; sometimes both species of *Peromyscus* were trapped in the same building.

A small number of *Peromyscus* collected in woodland habitats have not yet been definitely determined, many of their external characters being intermediate between the two species.

In the woods, both species of *Peromyscus* spend considerable time in trees, and not infrequently have their nest in a cavity high above the ground. Relatively few traps were placed on trunks or branches of trees, yet a large proportion of such traps captured these mice. Deer mice were taken in such situations as 5 feet above the ground on a large, flat bracket fungus, 6 feet up on the horizontal branch of a white pine, 4 feet above the ground on a fallen tree trunk frequented by flying squirrels, 4 feet up a leaning trunk, etc. These mice also utilize tunnels of various small mammals in the leaf mold, and thus individuals have a large vertical range.

Food habits. Foods noted in the stomachs or found as feeding sign or in caches of these mice included seeds of hemlock, wild black cherry, maple and raspberry, fleshy fungi, insects (including beetles and caterpillars) and mammals. Two dozen fall and summer stomachs examined contained chiefly seeds and mast, but with insects comprising 100 percent of the fare in some stomachs. In several instances these mice were taken on the forest floor next to large, partly eaten mushrooms. These mice do not disdain to feed on dead animals, and a January stomach

was filled with the hair and flesh of a red squirrel, while two other stomachs in autumn contained undetermined mammalian remains.

Reproduction. Twelve pregnant, 4 pregnant and lactating, and 33 lactating females were taken between April 16 and October 17. The extreme dates are both for lactating mice; the latest pregnancy recorded was September 1. Embryo size ranged from 5 mm. to 19 mm. crown to rump. Litter size based on 55 embryo and placental scar counts average 5.1, with a range of 3 to 7; 5 was the most frequent number of young, and litters of 4 to 6 were common.

Measurements. Seventy-five adult males average: weight, 19.8 grams (16.3-25.3); total length, 184.7 mm. (171-201); tail, 94.4 mm. (83-105); hind foot, 20.4 mm. (18-22); ear from notch, 19.1 mm. (17-21). Sixty-five adult females without embryos average: weight, 20.1 grams (16.0-28.7); total length, 189.7 mm. (171-211); tail, 96.9 mm. (83-113); hind foot, 20.2 mm. (18.5-21); ear from notch, 19.3 mm. (17.5-21).

WHITE-FOOTED MOUSE

Peromyscus leucopus noveboracensis (Fischer)

Specimens taken. 440 (Otsego County, 112; Schoharie County, 328), in every month of the year.

Distribution and habitat. This is one of the most common small mammal species, for not only does it inhabit woods at all elevations in this region, but it also occurs in many open habitats and even enters houses on the outskirts of the villages. In a number of localities it was found to be the dominant small mammal, including such diverse habitats as cool, mature hemlock and spruce woods and barren, rocky pastures. Deciduous, coniferous and mixed woods, ravines, margins of streams, talus slopes, bushy meadows and weedy places, old fields, pastures, hay-fields and other agricultural land and barren road-cut banks all yielded their quota of these adaptable mice.

The two species of *Peromyscus* overlap broadly in the small altitudinal range in these counties, and they were found living in the same woods in about half of the localities trapped, although in a given locality one or the other species usually greatly outnumbered the other judging from trapping results. This zone of overlap extended from about 1,000 feet (5 *maniculatus* and 4 *leucopus* taken in a hemlock grove at 1,050 feet) to woods on tops of the higher hills (60 *maniculatus* and 25 *leucopus* taken in woods at 2,300 feet, the highest elevation trapped). Up to nearly 1,600 feet *leucopus* was usually, although not always, the dominant species, while in woods at roughly 1,600 feet and above, *maniculatus*

considerably outnumbered *leucopus* in most localities trapped. Exceptions included a stand of mature red spruce at 2,060 feet, a cool "northern" environment in Schoharie County in which, surprisingly to me, 13 *leucopus* but no *maniculatus* were taken.

In open, nonwooded habitats *leucopus* was the more common species at all elevations, and was taken in several old fields above 2,000 feet. This was demonstrated in a trapping area near Summit; while *maniculatus* occurred exclusively in a woodland here at 2,100 feet altitude, in fields on a windswept hill 150 to 200 feet above the woods only *leucopus* was found. Out toward the center of a large rocky pasture at 2,050 feet few small mammals were taken in August 1957, aside from 28 specimens of *leucopus*; here the scattered rocks and rocky outcrops probably furnished cover necessary for the existence of this species, although it was also taken in poverty grass (*Danthonia spicata*) a considerable distance from any rocks. Two *maniculatus* were taken in this same pasture but at an exceptionally large rocky outcrop. *P. leucopus* was also taken in various kinds of agricultural land, and on some large stony road-cut banks with very sparse vegetation this was the commonest small mammal species.

P. leucopus was the common species also in brushy areas and second-growth woods. On Burnt Hill in Schoharie County, traplines were set out in several woodland areas between 1,400 and 1,960 feet where beech, sugar maple, red maple, striped maple, yellow birch, white pine and hemlock were common trees in woods approaching maturity; *maniculatus* was the common species in every locality, 97 being taken as opposed to only 13 *leucopus*. On this same hill, however, in a young second-growth woods of quaking aspen, gray birch, red maple and various shrubs at an elevation of 2,000 feet, 10 *leucopus* and only 1 *maniculatus* were taken.

Rocky stream shores in the woods were often quite productive of these mice, and on wooded talus slopes in the Gilboa region at about 1,300 feet elevation they were found living in close association with *maniculatus*, outnumbering the latter by about 2 to 1. White-footed mice were trapped in abandoned and occasionally inhabited buildings in the woods, on farms and on the edge of villages.

Food habits. Both species of *Peromyscus* include a wide assortment of foods in their diet. Seeds, including those of hemlock and wild black cherry, nannyberries, green plant matter and insects, including caterpillars, crickets and beetles, were noted in the stomachs or as "sign" at feeding stations where this species was trapped. Twenty summer stomachs examined contained chiefly seeds, mast and insects. Both species of *Peromyscus*, like *Blarina*, were not infrequently attracted to meat-baited traps set for weasels and flying squirrels.

Reproduction. Twenty-five pregnant, 3 pregnant and lactating, and 20 lactating females were taken. The earliest pregnant female was taken on March 25 and the latest on November 30, indicating a long breeding season. The latest lactation date was December 3. Embryo size ranged from 2 to 22 mm. crown to rump. Average litter size based on 44 embryo and placental scar counts is 4.3, with a range of 1 to 8; 4 was the most frequent number of young, with litters of 3 to 5 being common.

Measurements. Seventy-five adult males average: weight, 21.4 grams (16.2-26.8); total length, 172.0 mm. (159-186); tail, 79.2 mm. (71-87); hind foot, 19.6 mm. (19-21); ear from notch, 17.2 mm. (15.5-19). Thirty adult females without embryos average: weight, 21.0 grams (15.5-27.9); total length, 172.5 mm. (153-196); tail, 79.7 mm. (69-90); hind foot, 19.7 mm. (19-20.5); ear from notch, 17.2 mm. (16-19).

SOUTHERN BOG LEMMING

Synaptomys cooperi cooperi Baird

Specimens taken. 56 (Otsego County, 24; Schoharie County, 32), in every month except January, February and March.

Distribution and habitat. *Synaptomys* has been reported from a rather large variety of habitats in different parts of its geographical range. In this region it is essentially a forest species. The preferred, or typical, habitat is deciduous woodland (generally sugar maple and beech dominant, but occasionally red maple, oak or hemlock in abundance) where sedges of the genus *Carex* cover much of the ground and friable soil and humus permit extensive tunneling. Trapping in such habitat usually produced specimens, and, since this habitat covers extensive areas in the two counties, it is felt that *Synaptomys* is quite generally distributed in the region. In its preferred habitat in several localities trapping indicated that it was the most numerous microtine. Some specimens also were trapped in woods where the herbaceous cover was thinner, consisting of scattered ferns and sedges. Somewhat over a fourth of the specimens were trapped along the edges of woods or in small woodland clearings. None were taken in bogs or marshes, and only one was taken in open grassland in typical *Microtus* habitat. Altogether *Synaptomys* was taken on 17 different traplines in 9 widely separated localities. Hamilton (1941) has reported on the occurrence of this species in forest habitat in Albany County.

The locating of its conspicuous sign of numerous cuttings and bright green droppings aided in trapping *Synaptomys*. *Microtus*, the "sign" of which at times rather closely resembles that of *Synaptomys*, is rare in the usual *Synaptomys* habitat in this region except in the woodland edge

situations where the two species sometimes occur together. *Pitymys*, more than the other microtines, in this region seems to have requirements most closely approaching those of *Synaptomys* and the two species were frequently taken together in the same woodland areas and often in the same traps on different days. Similarly Saunders (1932) states that in southern Ontario, where he took these two species together on several occasions, where one of these microtines is found the other is likely to occur. In southern New Jersey there is a different habitat arrangement of the same microtine species; there I have trapped *Synaptomys* in sphagnum bogs with *Microtus* and *Clethrionomys*, while *Pitymys* is confined chiefly to dry woods and fields.

Other common small mammal associates of *Synaptomys* in the present study were *Parascalops*, *Blarina*, *Sorex fumeus*, *Peromyscus m. gracilis*, *Clethrionomys*, and *Napaeozapus*.

An example of good *Synaptomys* habitat is the flat top of Petersburg Mountain (elevation 2,300 feet) three miles southeast of Cobleskill. Here under a stand of somewhat stunted trees, chiefly sugar maple, is a nearly continuous layer of *Carex pennsylvanica*. Tunnels of small animals were numerous in the humus under the leaf litter and sedge, and here 20 bog lemmings, 4 pine voles, 1 meadow vole and 9 red-backed mice were trapped, as well as shrews, hairy-tailed moles and other species. In a narrow clearing nearby on the same hill (under the telephone line to the fire tower) in sedge, grass and ferns 5 additional bog lemmings were taken, together with 2 meadow voles. Bog lemmings were known to have continuously occupied this same area at least from September 1957 to September 1958. Another good location for *Synaptomys* was in the densely wooded cabin area of Gilbert Lake State Park. In the fall of 1956, 11 were trapped here in shady situations in and near the yards of the cabins (often under hemlocks) in sedge and grass.

Two catches were made in what seemed unusual habitat for this region. One was in a mat of bluegrass (*Poa* sp.) in an old field where *Microtus* was common, but where there were scattered small saplings of white ash and aspen. Another was halfway up a steep, rather bare talus slope near where several *Sorex dispar* were collected; the trap was set in a recess under the rocks beneath a thin stand of paper birches with scattered marginal woodferns (*Dryopteris marginalis*) the only green herbaceous plants in the vicinity. Both of these instances probably indicated higher populations in more suitable habitat nearby; in fact the first area was half a mile from a wooded area where several bog lemmings were collected.

Most of the specimens were taken in traps set in tunnels, including large ones made by hairy-tailed moles, as well as smaller ones apparently

made by bog lemmings, other mice and short-tailed shrews. Others were caught as they emerged from holes in rotten stumps and logs, and occasionally they were taken in surface traps set at sites of heavy cuttings in growths of sedge. Ten were caught in sunken cans half-filled with water, while the remainder were taken in standard size mousetraps. Trapping of this species was most productive during the fall months (September to November) when over half (31) of the specimens were secured.

Food habits. *Synaptomys* feeds chiefly on the vegetative parts of sedges, grasses and related plants. Of 42 stomachs examined (April to December), green vegetation, chiefly the leaves of sedges and grasses, occurred in every stomach and comprised an estimated 73 percent of the total volume. The white basal parts and rootstocks of sedge and similar material were noted in 9 stomachs and made up about 12 percent of the total bulk. Other foods, occurring in small proportions in the stomachs, included seeds of grasses, spores of an undetermined fungus (*Endogone?*), rolled oats bait and several unidentified materials.

Field evidence based on cuttings observed indicated frequent feeding by these rodents on the green leaves and stems of the following: *Carex pennsylvanica* and other sedges, bluegrass (*Poa* sp.), mountain ricegrass (*Oryzopsis asperifolia*) and ground pine (*Lycopodium complanatum*). In many areas small woodland sedges (often *Carex pennsylvanica*) apparently formed the main source of food throughout all or most of the year; all vegetative parts of these plants are utilized: leaves, white basal parts and rootstocks. Green cuttings of *L. complanatum* were frequently noted in spring and fall (reported also as food by Richmond and Roslund, 1949).

Synaptomys was usually taken by strategically placed traps with or without bait; however, rolled oats (sprinkled as bait near some of the traps) were found in the stomachs or mouths of four bog lemmings and peanut butter bait was found in the mouth of another. These were trapped in the months of April, July and October.

Reproduction. Investigators have recorded from 1 to 7 young per litter in *Synaptomys*. Information relating to females taken in this survey is given in table 6. Most of the females collected were trapped in the fall, hence the preponderance of fall breeding data.

On October 30 and 31, 1956, four juveniles, apparently litter mates just out of the nest, averaged 10.9 grams (range 10.6-11.7). These were taken in two traps set at old stumps on the edge of the woods adjacent to the backyard of our cabin headquarters at Gilbert Lake. At the same time (October 30) a nursing adult female was trapped in a hairy-tailed mole tunnel 70 feet across the yard from where the small young were

TABLE 6
Reproductive data for female *Synaptomys cooperi*

DATE	NUMBER AND SIZE OF EMBRYOS	NUMBER OF PLACENTAL SCARS	REMARKS
April 17, 1957	3		
May 19, 1958	4 (7.5 mm.)		Additional embryo being reabsorbed
September 12, 1958	3 (14 mm. crown to rump)		
September 27, 1957	2 (7.5 mm.)	2(?)	Lactating
October 5, 1956		2	Lactating
October 30, 1956		8	Recent parturition; lactating
November 5, 1957		2	
November 20, 1956		3	Recently lactating

taken. But this adult female showed evidence of very recent parturition (stretched uterus, apparently placental material in stomach) and had eight distinct placental scars. Possibly the young ones trapped were those of the previous litter of this female and had been recently abandoned by her in preparation for the new litter or they may have been the young of another mother residing nearby.

Males which apparently were in breeding condition, with testes measuring 6 to 7 mm. in length (about the maximum size in this species) and with accessory structures enlarged, were taken in every month from April to November.

Remarks. Almost twice as many males as females were trapped: 34 males and 19 females were recorded.

Four adult males when collected showed old healed injuries, which may have resulted from fighting. One was without a right hind leg; another lacked a tail; another had most of its right ear pinna and a toe missing; and another had lost all of its left ear pinna.

Measurements. The two sexes in this species are closely alike in size (Howell, 1927; Wetzel, 1955; Connor, 1959). Twenty-two adult males average: weight, 25.9 grams (21.5-32.6); total length, 119.1 mm. (112-133); tail, 20.4 mm. (17-24); hind foot, 17.5 mm. (16-19.5). Twelve adult females average: weight, 25.3 grams (21.4-30.1); total length, 118.7 mm. (111-126); tail, 21.1 mm. (19-26); hind foot, 17.2 mm. (16.5-18).

RED-BACKED MOUSE

Clethrionomys gapperi gapperi (Vigors)

Specimens taken. 164 (Otsego County, 92; Schoharie County, 72), in every month of the year.

Distribution and habitat. In this region, red-backed mice do not occur in such abundance as they do in the extensive boreal forests of the Adirondacks or in the higher elevations of the Catskill Mountains (Mearns, 1898, stated that it was common everywhere at higher elevations in the Catskills and so numerous on the summit of Hunter Mountain, elevation 4,025 feet, that it was difficult to trap any other small mammal there). Although rarely the most numerous small mammal in a locality, this species is rather generally distributed throughout the two counties and is not restricted to any one environment or forest type. In general, moist, cool, shady forest habitats are preferred. Largest populations were encountered in a low-lying arbor vitae swamp (elevation 1,200 feet), on a slope forested with large hemlocks (elevation 1,450 feet) and in a stand of hemlock and red spruce bordering a small lake (elevation 2,300 feet). Both of the first two areas are located near the northern end of Otsego Lake while the last named habitat is near Summit in Schoharie County. At the first and last mentioned localities it was the most numerous small mammal trapped while on the hemlock-covered slope it was outnumbered only by *Peromyscus leucopus*. None were taken in two small "boreal islands" of red spruce and balsam fir, which seemed ideal habitats.

Nearly half of all specimens taken were secured in mixed woods (hemlock-deciduous) and in deciduous woods lacking conifers; some other factor than the presence or absence of hemlocks seemed to govern their abundance in these areas. In Gilbert Lake State Park in Otsego County and on Burnt Hill in Schoharie County, red-backed mice were not uncommon in woods of sugar maple and beech and also in moist woods composed chiefly of red maple. Occasionally small numbers of these mice were taken along old rock walls on land formerly farmed. Rocky outcrops and talus slopes (including those inhabited by *Sorex dispar*) were found to be not especially good situations to collect these mice in this region; in such habitats they formed only a minor component of the small mammal population being greatly outnumbered by *Peromyscus* and various shrews.

Jameson (1949) states that *Clethrionomys* is boreal in its geographic distribution, but that altitude itself is not a decisive factor in its local distribution in the Ithaca region. Such would also seem to be the case in the area of this survey. Specimens were collected at localities ranging from 1,200 to 2,300 feet in altitude, with elevation apparently playing a

minor part in its local distribution. The largest catch for any one locality, the arbor vitae swamp mentioned previously (34 taken), was also the lowest elevation at which this species was trapped.

As Batchelder (1896) mentioned regarding *Clethrionomys* in eastern Massachusetts, the reduction of moist and deeply forested areas since primeval days has undoubtedly deprived this species of much territory although the recent trend back to forest cover in many areas has probably favored this as well as certain other species. Roslund (1951) states that *Clethrionomys* in north-central Pennsylvania is apparently a victim of deer competition, and that it is common in suitable habitat only where deer damage is not extensive.

The herbaceous cover ranged from sparse to luxuriant in areas where we trapped these mice, but ferns and various forbs are undoubtedly important in furnishing food and cover, as has been shown by various authors. Good spots to set traps for these mice were about stumps, logs, uprooted trees and brush piles, at holes at the base of trees and in tunnels under the leaf litter. Specimens also were occasionally secured on the tops of stumps and on the trunks of fallen trees above the ground. These mice were especially easy to trap after light falls of snow when a maze of their tracks would often be found concentrated about certain logs and other surface debris.

Common associates of the red-backed mice were *Blarina*, *Sorex*, the two species of *Peromyscus*, chipmunks, red squirrels, flying squirrels and woodland jumping mice. In deciduous or mixed woodlands, *Synaptomys* and *Pitymys* were frequent associates. In the arbor vitae swamp mentioned previously, *Sorex cinereus* was the most numerous small mammal taken aside from *Clethrionomys*; a small number of meadow voles also were taken in this habitat.

Food habits. Finely comminuted green, white and brownish materials were generally present in the stomachs; these materials were usually difficult to identify. Nuts and seeds, green leaves of ferns or other woodland herbs and perhaps roots and fungi were included in the stomach contents of 12 specimens examined; no remains of insects or other animals were noted in these stomachs.

Reproduction. The reproductive status of trapped females indicated a long breeding season (table 7). A female with 5 distinct placental scars on March 10 may have indicated a litter born in the winter. Twenty-seven embryo and placental scar counts averaged 4.5 and indicated 3 to 5 as the usual number of young per litter although up to 8 placental scars were counted. Data given in table 11 for April 23-24, 1957, are for females taken in Greene County (Hunter Mountain), outside the strict confines of the area covered by this report.

TABLE 7
Reproductive data for female *Clethrionomys gapperi*

DATE	NUMBER AND SIZE OF EMBRYOS	NUMBER OF PLACENTAL SCARS	REMARKS
March 10, 1957		5	
April 23, 1957		4	
April 24, 1957		5	Recent parturition; lactating
April 24, 1957	5 (12 mm. crown to rump)		
April 24, 1957	4 (5 mm.)	Present	
April 24, 1957		5	Recent parturition; lactating
June 18, 1957		4	
June 28, 1958	4		
July 3, 1957		7	
July 4, 1956	5 (8 mm.)		
July 10, 1956		3	
July 16, 1957	3 (7 mm.)	5	Lactating
July 16, 1957		5	Lactating
July 17, 1957		5	Lactating
July 17, 1957		5	Lactating; old placental scars also present
July 17, 1956		4	Lactating
July 19, 1958	3 (3 mm.)		Additional embryo being reabsorbed
July 25, 1956	3 (5 mm.)		
July 26, 1957		3	Lactating
August 1, 1956	4 (10 mm. crown to rump)		
August 13, 1957		4	Lactating; old placental scars also present
August 24, 1956		8	Recently lactating
September 26, 1956	5 (9 mm.)		
October 26, 1956		6	Recently lactating
November 7, 1957		5	Old placental scars also present
November 28, 1956		3	Recent parturition; lactating

Numerous males, with all appearances of being in breeding condition, including large testes measuring 10 to 13 mm. in length, were taken from late March to early October. All of the 13 adult males taken in January, February and early March 1957 were nonfertile, with testes rarely measuring more than 4 mm. in length. (The several specimens

taken from late October to December appeared to be in a regressing condition, with testes of intermediate size.) Three males taken in the last week of March, as well as all adult males taken in April, were in apparent breeding condition.

Remarks. In numbers trapped, males greatly outnumbered females: of 147 sexed specimens there were 93 males and 54 females.

Measurements. Forty adult males average: 24.5 grams (19.3-35.9) ; total length, 138.0 mm. (126-155) ; tail, 39.2 mm. (31-45) ; hind foot, 17.8 mm. (16.5-19.5). Twenty-four nonpregnant adult females average: weight, 22.7 grams (16.9-31.8) ; total length, 137.9 mm. (123-156) ; tail, 39.8 mm. (32-47) ; hind foot, 17.5 mm. (16-19.5).

MEADOW VOLE

Microtus pennsylvanicus pennsylvanicus (Ord)

Specimens taken. 265 (Otsego County, 173; Schoharie County, 92), in every month of the year.

Distribution and habitat. Meadow voles, or meadow mice, were encountered in a large variety of grassy and sedgy habitats at all elevations. Low, moist meadows and marshy margins of ponds and streams were favored habitats. In some localities, dry upland fields and hayfields harbored large numbers of these mice. Others were trapped in grassy clearings in the woods, in wooded swamps, in sphagnum bogs, in grass along the edge of cornfields, in shrubby and weedy areas, in grassy yards and on a golf course (in winter).

Occasionally single specimens or small colonies were met with in wooded sections: in small clearings, in herbaceous vegetation along small shaded woodland streams and in some woods where the trees were sufficiently spaced to permit an adequate growth of sedge or grass. One specimen was trapped on the top of a stump in a small blackberry patch in the woods; another was taken in a *Synaptomys* tunnel in the humus in sugar maple and beech woods. Along a narrow, little used woods road in Gilbert Lake State Park in a small patch of grass a few yards across, beneath an interlocking canopy of tall forest trees, a *Microtus pennsylvanicus* nest with young was found in July 1956. Several young escaped from the nest, but one, with eyes still closed and weighing 9.0 grams, was collected. Within a few inches of the nest a lactating female carrying 10 embryos, undoubtedly the mother of the nest young, and an adult male were caught. Perhaps woods roads, where bordered by some grass or other herbaceous vegetation, may serve as highways of travel for meadow voles through wooded sections. Altogether about 40 meadow

voles were collected in woodland and woodland edge habitats; in general, however, this species is much less frequently associated with trees than the other microtines (*Synaptomys*, *Clethrionomys* and *Pitymys*) occurring in this region.

In a swamp of young arbor vitae in winter, meadow voles were common and bred in situations where there was much grass and sedge on the ground as well as numerous logs and stumps. Here red-backed mice and masked shrews were common associates.

Under the protective covering of deep snow these mice may be active in such bare habitats as golf courses and lawns. In a winter thaw early in 1957 the melting away of the snow revealed their surface (subnivean) runways covering large areas of a golf green; traps set deep in *Condylura* tunnels here secured half a dozen *Microtus*. Meadow voles were active in our headquarters lawn under the deep snow of early 1958; when the snow finally receded in early April abundant signs of their activity were exposed: narrow surface runways which had been under the snow, holes to subsurface tunnels, pits in the ground, small piles of earth, and dirt cores which had been pushed into the tunnels.

In October a meadow vole was trapped in the cellar of a house, along with a short-tailed shrew, white-footed mice and house mice.

In some upland pastures, where poverty grass was dominant and where rocky outcrops were numerous, *Microtus* was not taken and *Peromyscus leucopus* was the common small mammal. In such areas *Microtus* probably occurs only in occasional low moist spots of denser vegetation.

During the summer of 1956 I had the impression that *Microtus* was scarce in suitable habitats in some areas of the region, especially the southern part of Otsego County. Many low meadows and damp spots in fields seemed to be without these mice or had only old signs of their presence. Star-nosed moles seemed common in many of the same areas.

Food habits. A vast array of vegetable foods have been recorded for *Microtus*, including green leaves and stems, roots, bark and seeds of many plants. Casual observations made in this study indicated the following plants were eaten: various parts of grasses and sedges, including bluegrass (*Poa*), orchard grass (*Dactylis glomerata*), timothy (*Phleum pratense*), poverty grass (*Danthonia*), bulrush (*Scirpus*) and sedge (*Carex*) and in winter the twigs of red osier (*Cornus stolonifera*). *Microtus* is less strictly confined to a green leafy diet than *Synaptomys*, and usually the droppings were not as bright a green as those of *Synaptomys* occurring in the same habitat.

Remarks. Few specimens taken showed any indication of albinism. One individual had a patch of pure white hairs on the crown and scat-

tered white hairs on the nape while another mouse from the same locality had white hairs on the tip of the tail.

Reproduction. The meadow mouse is our most prolific mammal, one litter following another in rapid succession from early spring to autumn. In some years part of the population may breed during the winter. Reproductive data is presented in table 8. Number of embryos average 5.3. In

TABLE 8
Reproductive data for female *Microtus pennsylvanicus*

DATE	NUMBER AND SIZE OF EMBRYOS	NUMBER OF PLACENTAL SCARS	REMARKS
January 9, 1957	4 (12 mm. crown to rump)	5	Additional embryo being reabsorbed Recent parturition; lactating Lactating
May 17, 1957	6 (20 mm. crown to rump)		
May 17, 1957			
May 18, 1957	5 (3 mm.)		
June 26, 1957	4 (17 mm. crown to rump)		
June 26, 1957	5 (21 mm. crown to rump)	6	Additional embryo being reabsorbed
June 26, 1957	7 (18 mm. crown to rump)		
June 30, 1956			Lactating
June 30, 1956	4 (11 mm. crown to rump)		
July 4, 1956			Lactating
July 4, 1956	5 (6 mm.)	5	Lactating
July 9, 1956	10 (8 mm.)		Lactating
July 9, 1956			Lactating
July 10, 1956			Lactating
July 11, 1956			
July 18, 1956		3	Lactating
July 18, 1956	7 (full term)		Gave birth after capture
August 9, 1956	5 (7 mm.)	7	Nearly full term
August 31, 1956	5 (26 mm. crown to rump)		
October 4, 1957			
October 9, 1956			
October 19, 1956	2 (13 mm. crown to rump)		
October 23, 1956		4(?)	Recently lactating
			Lactating
		4(?)	

the winter of 1956-57 breeding occurred, at least in the Otsego Lake region. Besides the female with embryos on January 9, several males in breeding condition was taken in two localities between January 10 and 25 (testes 13-15 mm. in length and descended, and tubules of cauda epididymis enlarged); the reproductive tracts of other males were in a nonfertile condition through the month of March.

Measurements. Forty-five adult males average: weight, 35.3 grams (28.3-63.9); total length, 162.6 mm. (148-188); tail, 47.1 mm. (33-58); hind foot, 20.4 mm. (19-22). Sixteen adult females without embryos average: weight, 35.4 grams (27.9-50.9); total length, 162.5 mm. (142-180); tail, 46.9 mm. (41-53); hind foot, 19.8 mm. (19-21).

PINE VOLE

Pitymys pinetorum scalopsoides (Audubon and Bachman)

Specimens taken. 20 (Otsego County, 16; Schoharie County, 4), in March, April, July, August, September, October and November.

Distribution and habitat. Pine voles, or pine mice, in this region were taken only in deciduous woodlands. Although found in a wide variety of plant associations in different parts of its range, soil type is probably an important factor governing the distribution of *Pitymys* (Jameson, 1949; Benton, 1955); friable humus or light, well-drained soils, where tunneling is easy, are favored. In central New York, near the northern limit of its range, many seemingly suitable areas are apparently without this fossorial vole. It seemed to be common nowhere; rarely did trapping yield more than 1 to 3 on a trapline. Eight were secured in Gilbert Lake State Park, Otsego County, in the summer of 1956. Other localities were near Cooperstown, South Valley, Milford, Oneonta in Otsego County and near Cobleskill in Schoharie County.

Sugar maple, or sugar maple and beech, were dominant in all of the areas in which *Pitymys* was taken; striped maple, black cherry and scattered hemlock were frequently present. On almost all of the areas the trees were rather large and well-spaced, giving much shade; however, three were taken in a stand of small second-growth trees near old stone walls on long-abandoned farmland. The herb layer was generally scattered ferns, sedges or maple seedlings and in one locality a continuous layer of *Carex pennsylvanica*; several specimens were taken in the loose, friable soil of blackberry and raspberry thickets in small woodland openings.

Most of the specimens were taken on traplines located between 1,400 feet and 1,700 feet in elevation, but pine voles also occurred up to at least 2,300 feet in altitude on the tops of some of the higher hills. One

would expect this species at low elevations in the valleys of the main streams. Indeed, in a few localities near the banks of the Susquehanna River and Schoharie Creek, in one place in an open sandy field, we found numerous tunnels which were judged to be the work of pine voles. Trapping of these tunnels, however, yielded only a few *Blarina*.

The majority of the catches were in traps set in subsurface runways in the humus. Usually we were unaware of the presence of *Pitymys* beforehand, except that some of the tunnels, being in woodland and of vole size and shape, suggested either *Synaptomys* or *Pitymys*. Occasionally, the tunnels in which pine mice were taken were visible from above as short ridges, with openings to the surface frequent. Three were taken in the large tunnels of *Parascalops*. Five were caught on the surface: three next to an old stone wall, a stump and a log, respectively, and two in the open on top of the leaf litter, but in every case subsurface runways abounded in the vicinity.

Blarina was the commonest associate, abundant in all areas in which *Pitymys* was collected, and both species were taken in the same tunnels. *Synaptomys* and *Pitymys* in this region seem to have very similar habitat requirements although the former has fewer fossorial adaptations and the two differ in their food habits. Over half of the pine mice were taken in areas where the apparently more numerous *Synaptomys* also occurred. *Clethrionomys* and *Sorex fumeus* were common in most of the areas where *Pitymys* was taken.

Food habits. Of 13 stomachs looked at (various months), roots and other underground or basal parts of plants occurred in 10 of the stomachs and comprised about two-thirds of the total volume of food, the remainder being chiefly green vegetation. Two stomachs contained a small amount of animal matter, one the remains of unidentified insects, the other flesh and hair possibly of a young mouse. On the top of Petersburg Mountain (elevation 2,300 feet) in November 1957, these mice were feeding on *Carex pennsylvanica*; two stomachs contained exclusively the stolons, roots and the white basal parts of the leaves and shoots of this sedge. In the same area bog lemmings were common but were feeding heavily on the green leafy parts of this plant. Pine mice in traps were often partly eaten, no doubt frequently the work of other pine mice.

Reproduction. Too few specimens were taken to give much information on breeding habits. Litters tend to be small in this species, the usual number of young being 2 to 4 (Hamilton, 1938). Five females trapped indicated litters within this range: July 10, 1956, 2 embryos at 11 mm.; August 23, 1956, 4 placental scars; September 8, 1958, 3 placental scars and lactating; September 25, 1956, 3 embryos at 7 mm.; November 7, 1957, 2 placental scars.

Measurements. Ten adults average: weight, 26.1 grams (22.4-29.1); total length, 123.0 mm. (116-123); tail, 21.1 mm. (19-26); hind foot, 15.4 mm. (14-17).

NORWAY RAT

Rattus norvegicus (Berkenhout)

Specimens taken. 14 (Otsego County, 11; Schoharie County, 3).

Remarks. Rats are common in and near places of human habitation and occur in great numbers on farms; during the warmer months fields, marshes and stream banks may be occupied by these pests. In early October 1956, they were found in large numbers in marshes near the railroad yards at Oneonta. Here the rats were trapped at their burrows along the edge of higher ground, and in muskrat trails in the sedge, cattails, joe-pye weed and other marsh vegetation. A female taken here October 9 was carrying 10 large embryos.

HOUSE MOUSE

Mus musculus domesticus Ratty

Specimens taken. 32 (Otsego County, 3; Schoharie County, 29).

Remarks. Like the rat, the house mouse is common in and about buildings. In summer many live outdoors in woods, fields and farmland. In October 1957, house mice appeared to be quite common in low-lying agricultural land along the Schoharie Creek near the village of Schoharie. Here they were trapped in strips of timothy, other grasses and goldenrod bordering a cornfield in company with *Blarina*, *Peromyscus leucopus*, *Microtus* and *Zapus*. In May 1957, one was taken in a grazed beech-sugar maple woods, the only instance in this study in which this species was collected in woodland habitat. Often these mice were trapped in the same buildings with white-footed mice. In a storeroom of our Schoharie County headquarters an adult female and eight small young recently out of the nest were collected in October.

MEADOW JUMPING MOUSE

Zapus hudsonius americanus (Barton)

Specimens taken. 81 (Otsego County, 34; Schoharie County, 47), in every month from May to October.

Distribution and habitat. Although the various habitats were not covered equally, these long-tailed mice were most often taken in low meadows and rank vegetation near streams, on dry grassy slopes near ponds or other water and along the narrow marshy fringes of ponds in

wooded sections; in smaller numbers, specimens were also secured in agricultural land, in sphagnum bogs and in thin woods and small woodland openings. Occasionally we failed to find this species in seemingly favorable situations. Specimens were trapped throughout the full altitudinal range covered in this survey (600 to 2,300 feet). *Condylura*, *Blarina*, *Microtus* and *Peromyscus leucopus* were typical associates of *Zapus*.

Food habits. Of 15 stomachs examined, about 90 percent of the food by volume was composed of vegetation, chiefly the seeds of grasses. The remaining 10 percent consisted of insects and other invertebrates. Signs of feeding on seed heads of grasses and other plants were frequently observed where we trapped these mice.

Hibernation. The date of the last individual trapped in autumn was October 10, 1956 (elevation 1,080 feet). The earliest specimen collected in spring was trapped on May 18, 1957 (elevation 1,100 feet).

Reproduction. Reproductive data is given in table 9. Many females apparently brought forth their young during July in the period of this study, and the data suggest this as a possible peak in the breeding season. However, trapping of *Zapus* in June was limited.

TABLE 9
Reproductive data for female *Zapus hudsonius*

DATE	NUMBER AND SIZE OF EMBRYOS	NUMBER OF PLACENTAL SCARS	REMARKS
June 30, 1956			Lactating
July 10, 1958	4 (full term)		
July 11, 1958	5 (10.5 mm. crown to rump)		
July 12, 1958		4	
July 15, 1958	6 (small)		
July 16, 1957		3	
July 17, 1957		4	Lactating
July 18, 1957			Lactating
July 18, 1957			Lactating
July 19, 1958	6 (5 mm.)		
July 20, 1956			Lactating
August 2, 1957		6	
August 15, 1956		Present	Lactating
August 15, 1956			Lactating
August 16, 1956		3	
August 21, 1956		Present	Lactating
August 21, 1956		Present	
August 31, 1956		4(?)	
September 1, 1956			Lactating
October 2, 1957		5(?)	Recently lactating

Remarks. For the subspecies name I have followed the latest taxonomic revision of the genus (Krutzsch, 1954) which assigns specimens from this region to *Z. h. americanus*.

Measurements. Fifteen adult males without hibernation fat average: weight, 17.1 grams (14.9-19.7); total length, 215.0 mm. (206-229); tail, 129.3 mm. (119-139); hind foot, 29.1 mm. (27-32). Twenty-two adult nonpregnant females without hibernation fat average: weight, 18.8 grams (16.4-23.1); total length, 219.3 mm. (210-238); tail, 131.5 mm. (119-145); hind foot, 29.7 mm. (28.5-31).

WOODLAND JUMPING MOUSE

Napaeozapus insignis insignis (Miller)

Specimens taken. 119 (Otsego County, 81; Schoharie County, 38), in every month from May to October.

Distribution and habitat. This beautiful species was captured in a rather large variety of situations in wooded areas throughout the region; cool forests of northern hardwoods and hemlock seemed the preferred environment. It apparently occurs at all altitudes in the counties wherever there are suitable woodland habitats; specimens were secured at localities ranging from about 1,000 to 2,300 feet in elevation.

Most of the specimens were taken beside or near water (under or close to forest cover), including swift or slow small woodland streams, rocky streams in steep ravines, meandering river, ponds and lakes, and occasionally wooded swamps. Yet fully one-third of all specimens taken were so far from permanent water that it seemed to be no factor in the individual ranges of these animals. Between May and September 1958, 18 were trapped in a sugar maple and beech woodland (ground cover chiefly sedge) on the summit of a hill over one-half mile from the nearest permanent stream.

In most of the places where woodland jumping mice were trapped, herbaceous cover, such as ferns or sedges, was common although in some ravines where these animals occurred plant ground cover was rather scarce on the rocky terrain. In one deep ravine, where, in September 1956, this species ranked second only to *Peromyscus maniculatus gracilis* in numbers trapped, yew (*Taxus canadensis*) was abundant. We frequently trapped these mice among the ferns, grasses and raspberries of woodland openings and edges. Although usually caught in surface traps, several specimens were taken in tunnels under the forest leaf litter or in marshy soil in traps set for moles and microtines.

Although *Zapus* and *Napaeozapus* usually seemed to be well-segregated, in a few instances both species were taken together in the same habitat,

sometimes in the same traps on different days. Habitats where the two jumping mice were most often caught side by side were the grassy, thinly wooded borders of streams, narrow marshy margins of woodland ponds and small clearings in the woods, situations which often seemed to combine characteristics of habitats preferred by both forms.

Hamilton (1935) and Preble (1956), if I understand them correctly, state that, although *Zapus* was sometimes taken in habitat occupied by *Napaeozapus*, the opposite did not occur in the areas of their investigations. In the present survey, at least one distinct instance of the latter was recorded: in August 1956, a woodland jumping mouse was trapped alongside *Zapus*, *Microtus* and *Condylura* in a marshy, open meadow near some alders but several hundred feet from the woods. Townsend (1935) found that *Napaeozapus* occasionally wanders out into moist meadows, and he states that this species is not so strictly confined to the woods as *Zapus* is to the meadow.

At Bear Swamp Pond (elevation 2,050 feet), near South Valley, in August 1956, 10 *Napaeozapus* were trapped in the open, narrow zone of wet soil, sedges, grasses and alders between the water and woods; five *Zapus* also were collected here. At Mud Lake (elevation 2,300 feet), near Summit in July 1957 in what seemed to my eye a very similar situation—a narrow sedgy zone between water and forest—14 *Zapus* but no *Napaeozapus* were taken although the latter was recorded from the woods nearby. If anything, the first area seemed more suitable to *Zapus*, the open marshy zone being slightly wider, with a greater growth of sedges. It is difficult to say why the woodland jumping mouse was dominant at the one place, and the meadow species at the other. Townsend (1935) speculated that *Napaeozapus* may tend to drive *Zapus* out; he had no definite evidence that such was the case, but mentioned an area where he felt that *Zapus* would have been present if *Napaeozapus* was not already there.

As stated by Miller (1899), settlement and clearing of the land probably restricted the range of *Napaeozapus*, while enlarging that of *Zapus*, although the trend today to reforestation has probably favored *Napaeozapus*.

Food habits. Of the 14 stomachs which have been examined, plant material comprised about 70 percent of the food, the remainder being chiefly insects; plant items included seeds, starchy roots and basal parts of plants, while a large part of the insect food consisted of the larvae of Lepidoptera. On the yew-covered ravine slope where *Napaeozapus* was common, as mentioned previously, I noted that fresh cuttings of yew twigs (and chewings on the branches) were made during the same night that a *Napaeozapus* was trapped only a few inches away.

Hibernation. The date of the last individual captured in fall was October 24, 1956 (elevation 1,450 feet). This one was an adult with much accumulated fat; the four others taken during the second half of October were young animals without fat. May 15 and 16, 1958, (elevation 2,100 and 2,200 feet) were the earliest dates of capture in spring.

Reproduction. Breeding data obtained indicates litters are brought forth from May to September (table 10). Early summer is considered to be the main breeding period in the species, with some females bearing a second litter later in the season. Embryo counts ranged from 3 to 6, the usual range in *Napaeozapus* (Hamilton, 1943), but as few as 2 and as many as 7 placental scars were counted.

TABLE 10
Reproductive data for female *Napaeozapus insignis*

DATE	NUMBER AND SIZE OF EMBRYOS	NUMBER OF PLACENTAL SCARS	REMARKS
June 4, 1957		Present	Lactating
June 6, 1957		Present	Lactating
June 9, 1957		4	Lactating
July 2, 1956			Lactating
July 4, 1956	6 (4 mm.)		
July 10, 1956		Present	Lactating
July 16, 1957	6 (14 mm. crown to rump)		
July 18, 1956	5 (5 mm.)		
July 19, 1956		3	Lactating
July 20, 1956		Present	Lactating
August 15, 1956		2	
August 16, 1956		3	Lactating
August 16, 1956		Present	Lactating
August 23, 1956		2	Lactating
August 23, 1956			Lactating
August 30, 1956		5	Lactating
August 30, 1956	5 (20 mm. crown to rump)		
August 31, 1956		4	Lactating
August 31, 1956		4(?)	Lactating
August 31, 1956		7	Lactating
September 1, 1956	3 (18 mm. crown to rump)		
September 12, 1958			Lactating

Measurements. Twenty-five adult males without hibernation fat average: weight, 20.4 grams (18.0-24.2) ; total length, 231.5 mm. (224-238) ;

tail, 142.3 mm. (134-149); hind foot, 29.9 mm. (28-31). Twenty-five nonpregnant adult females without hibernation fat average: weight, 22.4 grams (16.8-28.4); total length, 235.3 mm. (222-249); tail, 144.4 mm. (128-155); hind foot, 29.7 mm. (28-31).

SHORT-TAILED WEASEL

Mustela erminea cicognanii Bonaparte

Specimens taken. 18 (Otsego County, 6; Schoharie County, 12), in January, February, May, July, August, November and December.

Distribution and habitat. This small weasel is apparently common throughout the area. Specimens were trapped at localities ranging from 1,100 to 2,100 feet in elevation—in both damp and dry situations—in old fields, low meadows, bushy areas and at the edge of woods. Traps making captures were placed at small culverts, old stone walls and fence rows, isolated clumps of bushes and at the foundation of an abandoned barn. Although none were trapped in woodlands, one was observed at close range in a dark stand of hemlocks in a moist wooded area; in winter, tracks apparently of this species were seen in both deciduous and coniferous woods, as well as in open country.

Remarks. Usually more than one weasel occurs in a favorable locality, and after one specimen has been captured, resetting the same trap very often results in additional captures. Twice a male and a female, perhaps mated pairs, were caught in the same traps on successive days in May (the female with embryos) and July. One female and two males were taken in the same trap on successive days in November; also on two occasions two males were taken in the same trap on different days in January and May. A total of 11 males and 7 females were taken; all specimens were taken in rat snap traps.

In the deep snow of January, February and March 1958, snow tunnels of these weasels were often seen. Sometimes a trail showed where a weasel alternately traveled on top of and beneath the snow. Snow tunnels were also found near the ground beneath two or three feet of snow where there was little or no evidence of surface activity. Here they probably hunted mice among the open spaces at the base of the grass stems and in other retreats of the mice. One male was trapped under two feet of snow near a small stream and culvert; a snow tunnel about one and seven-eighths inches in diameter and located near the ground led from the culvert to the sheltered, snow-buried trap which took the weasel.

While checking mousetraps in Gilbert Lake State Park on July 1, 1956, a weasel, apparently a male of this species, was seen in the act of carrying away a "museum special" trap which held a *Peromyscus*. "Squeaking" by me temporarily diverted the weasel and it approached to within a few feet, running along deadfalls and in and out of cavities at the base of trees and stumps. Later it carried the trap with mouse out of sight into a cavity, where it proceeded to eat the mouse. A few minutes later I flushed the weasel from another entrance to the cavity and found the trap inside, with only a hind foot of the mouse remaining in the trap.

Food habits. Of the 17 stomachs examined, 10 were empty; 2 contained the remains of *Microtus*, 1 of *Peromyscus*, 1 of *Blarina* and 1 the remains of a young bird; 2 stomachs held red squirrel remains, but in both of these cases pieces of this rodent had been placed as bait near the traps. One female was carrying a freshly-killed pregnant *Microtus* when caught in a "museum special" mousetrap set in a meadow. Specimens were secured on both fresh and old meat bait, generally squirrel, mouse or shrew carcasses; during warm weather in May one was taken on a five-day old *Blarina* carcass, seemingly unattractive bait.

Reproduction. Little breeding data was obtained. A female taken May 5, 1958, had 5 embryos measuring 24-25 mm. crown to rump. The three males taken in May had conspicuous testes, which were twice as large (10 to 13 mm.) as in eight males taken between July and February (5 to 6 mm.).

Measurements. Eleven adult and subadult males average: weight, 97.5 grams (84.0-110.9); total length, 274.8 mm. (267-284); tail, 71.6 mm. (65-76); hind foot, 35.4 mm. (33-37). Six adult and subadult females average: weight, 62.8 grams (53.9-69.9); total length, 235.7 mm. (225-245); tail, 59.5 mm. (56-67); hind foot, 29.0 mm. (27.5-30).

LONG-TAILED WEASEL

Mustela frenata noveboracensis (Emmons)

Remarks. No long-tailed weasels were collected, although these animals occur in the region. Very small weasels mentioned by trappers most likely were females of *erminia*, while "large weasels" probably referred to this species. Hall (1951) lists a specimen of this weasel in the American Museum of Natural History from the village of Schoharie, Schoharie County. Our trapping of weasels, which was extremely limited and chiefly confined to the more elevated, hilly sections, suggests that *erminea* is the

commoner species in much of this region; also in winter no tracks were seen in these areas which seemed to be of the larger species. Hamilton (1933) states that, based on fur trade information, *erminea* apparently outnumbered *frenata* in a district along and 50 miles north of the Mohawk River in a ratio varying from 3 to 2 at Troy to 6 to 1 at Utica. Southward from the area covered in the present report the ratio changes rapidly in favor of the larger species, and *erminea* is scarce in most areas of Pennsylvania, as the various mammal survey reports from that State indicate.



Figure 2. Talus slope on Reed Hill, $1\frac{1}{2}$ miles north of Gilboa, Schoharie County, elevation 1,300 feet, November 11, 1957. *Sorex fumeus*, *S. dispar*, *Blarina*, *Peromyscus maniculatus*, *P. leucopus*, and *Clethrionomys* were trapped among the rocks here.



Figure 3. Arbor vitae swamp near Otsego Lake, Otsego County, elevation 1,200 feet, March 5, 1957. *Sorex cinereus*, *Tamiasciurus*, *Peromyscus leucopus*, *Clethrionomys*, and *Microtus pennsylvanicus* were common here in late winter.



Figure 4. Cabin area in Gilbert Lake State Park, Otsego County, elevation 1,600 feet, April 19, 1957. In November a specimen of *Microsorex* was trapped on the edge of white pine-red maple woods on the right; *Sorex cinereus*, *S. fumeus*, *Blarina*, *Parascalops*, *Glaucomys sabrinus*, *Peromyscus maniculatus*, and *Synaptomys* also were trapped in the area shown.



Figure 5. Mounds of *Condylura* near Otsego Lake, Otsego County, March 5, 1957. *Condylura* and *Microtus pennsylvanicus* were taken here in traps set in mole tunnels beneath the turf.



Figure 6. Woods of hemlock, sugar maple, beech, etc. near Cooperstown, Otsego County, elevation 1,650 feet, March 27, 1957. Traps here took *Sorex fumeus*, *Blarina*, *Parascalops*, *Tamias*, *Tamiasciurus*, *Glaucomys volans*, *Peromyscus maniculatus*, *P. leucopus*, *Clethrionomys*, and *Pitymys*. Three flying squirrels were trapped on the ground at base of hemlock on right.



Figure 7. Mixed woods in valley of West Kill, Schoharie County, elevation 1,060 feet, March 28, 1958, with late-lingering snow about 1½ feet deep on the ground. Trapping on the snow here in March secured *Sorex fumeus*, *Blarina*, *Tamiasciurus*, *Glaucomys sabrinus*, *Peromyscus maniculatus*, and *P. leucopus*.



Figure 8. View looking down phone line clearing from summit of Petersburg Mountain near the fire tower, Schoharie County, elevation 2,300 feet, December 31, 1957. Traps set in the clearing (near summit) at various seasons took *Sorex cinereus*, *S. fumeus*, *Microsorex*, *Blarina*, *Parascalops*, *Peromyscus maniculatus*, *Synaptomys*, and *Microtus pennsylvanicus*.



Figure 9. Woods of sugar maple and other trees on summit of Petersburg Mountain, Schoharie County, elevation 2,300 feet, December 31, 1957. Traps in these woods took *Sorex cinereus*, *S. fumeus*, *Blarina*, *Parascalops*, *Tamias*, *Sciurus carolinensis*, *Tamiasciurus*, *Glaucomys volans*, *G. sabrinus*, *Peromyscus maniculatus*, *P. leucopus*, *Synaptomys*, *Clethrionomys*, *Pitymys*, and *Napaeozapus*. In *Carex pennsylvanica*, shown protruding above the snow in places, were many cuttings of *Synaptomys*.



Figure 10. Mud Lake, near Summit, Schoharie County, elevation, 2,300 feet, July 17, 1957. *Myotis lucifugus* was common over the water in midsummer; *Con-dylura*, *Zapus*, and other species were collected along the marshy shore; traps in woods of red spruce and hemlock on the right took *Sorex cinereus*, *S. fumeus*, *Blarina*, *Tamias*, *Tamiasciurus*, *Glaucomys sabrinus*, *Peromyscus maniculatus*, and *Clethrionomys* (abundant).



Figure 11. Stand of red spruce, balsam fir and hemlock near Summit, Schoharie County, elevation 2,100 feet, July 11, 1957. *Sorex cinereus*, *Blarina*, *Tamias*, *Tamiasciurus*, *Glaucomys sabrinus*, *Peromyscus maniculatus*, and *Napaeozapus* were trapped in these woods in summer.



Figure 12. Woods containing large hemlocks near Otsego Lake, Otsego County, elevation 1,450 feet, March 5, 1957. *Blarina*, *Sciurus carolinensis*, *Tamiasciurus*, *Glaucomys volans*, *Peromyscus maniculatus*, *P. leucopus*, and *Clethrionomys* were trapped here in winter. The two last-named species were numerous; both red and flying squirrels were trapped on the large log shown.



Figure 13. Rocky pasture near Summit, Schoharie County, elevation 2,050 feet, August 20, 1957. *Peromyscus leucopus* was common here in summer.



Figure 14. Western end of Old Pond, near Hyndsville, Schoharie County, elevation 1,720 feet, June 28, 1958. *Myotis lucifugus* was common in summer; *Lasiurus borealis* and *L. cinereus* also were observed and collected here. *Blarina*, *Peromyscus leucopus*, and *Microtus pennsylvanicus* were trapped in the old fields.



Figure 15. Brushy fields near Cobleskill, Schoharie County, elevation 2,000 feet, October 21, 1957. *Sorex fumeus*, *Blarina*, *Peromyscus leucopus*, and *Microtus pennsylvanicus* were common here in the fall.

APPENDIX

LIST OF FLEA SPECIES BY HOST

The following list combines Otsego County fleas identified by Donald H. Miller and Schoharie County fleas identified by Allen H. Benton.

Host	Flea species	Males	Females
<i>Sorex fumeus</i>	<i>Nearctopsylla genalis laurentina</i>	2	4
	<i>Doratopsylla blarinae</i>	1	
	<i>Ctenophthalmus pseudagyrtes</i>	1	
<i>Sorex dispar</i>	<i>Nearctopsylla genalis laurentina</i>	1	
	<i>Doratopsylla blarinae</i>	1	
<i>Blarina brevicauda</i>	<i>Doratopsylla blarinae</i>	22	24
	<i>Hystrihopsylla tahavuaana</i>	2	1
	<i>Ctenophthalmus pseudagyrtes</i>	10	12
	<i>Nearctopsylla genalis laurentina</i>	12	10
	<i>Megabothris asio asio</i>	1	
	<i>Epitedia wenmanni wenmanni</i>		1
<i>Parascalops breweri</i>	<i>Hystrihopsylla tahavuaana</i>	3	2
	<i>Doratopsylla blarinae</i>	1	
	<i>Ctenophthalmus pseudagyrtes</i>	6	5
	<i>Peromyscopsylla hesperomys</i>	1	
<i>Condylura cristata</i>	<i>Hystrihopsylla tahavuaana</i>		1
	<i>Ctenophthalmus pseudagyrtes</i>	1	1
<i>Myotis lucifugus</i>	<i>Myodopsylla insignis</i>	27	82
<i>Sylvilagus floridanus</i>	<i>Cediopsylla simplex</i>	4	7
<i>Marmota monax</i>	<i>Oropsylla arctomys</i>	1	3
<i>Tamias striatus</i>	<i>Tamiohyla grandis</i>		5
	<i>Megabothris acerbus</i>	5	5
	<i>Orchopeas sp.</i>		1
	<i>Orchopeas howardii</i>	3	1
<i>Sciurus carolinensis</i>	<i>Orchopeas howardii</i>		1
<i>Tamiasciurus hudsonicus</i>	<i>Epitedia feceta</i>		2
	<i>Monopsyllus vision</i>	6	12
	<i>Orchopeas howardii</i>	14	36
	<i>Epitedia wenmanni wenmanni</i>		1
Nest of <i>Tamiasciurus</i>	<i>Orchopeas howardii</i>	16	20
	<i>Epitedia faceta</i>	6	9
<i>Glaucomys volans</i>	<i>Conorhinopsylla stanfordi</i>	5	9
	<i>Opisodasys pseudarctomys</i>	9	5
	<i>Orchopeas howardii</i>	3	3
	<i>Peromyscopsylla catatina</i>		1
	<i>Ctenophthalmus pseudagyrtes</i>		1
	<i>Opisodasys pseudarctomys</i>	17	20
<i>Glaucomys sabrinus</i>	<i>Orchopeas howardii</i>	7	9
	<i>Orchopeas leucopus</i>	1	11
	<i>Epitedia wenmanni wenmanni</i>	5	3
	<i>Orchopeas leucopus</i>	31	62
<i>Peromyscus maniculatus</i>	<i>Peromyscopsylla hesperomys</i>	9	20

<i>Host</i>	<i>Flea species</i>	<i>Males</i>	<i>Females</i>
<i>Peromyscus</i> sp.	<i>Peromyscopsylla hesperomys</i>	1	2
	<i>Epitedia wenmanni wenmanni</i>	1	2
	<i>Ctenophthalmus pseudagyrtes</i>	1	
	<i>Orchopeas leucopus</i>	11	21
<i>Synaptomys cooperi</i>	<i>Megabothris asio asio</i>	1	
<i>Clethrionomys gapperi</i>	<i>Catallagia borealis</i>		1
	<i>Epitedia wenmanni wenmanni</i>	2	1
	<i>Ctenophthalmus pseudagyrtes</i>		1
	<i>Orchopeas leucopus</i>		1
	<i>Peromyscopsylla catatina</i>	3	1
	<i>Nearctopsylla genalis laurentina</i>		1
	<i>Saphiopsylla bishopi</i>	4	11
<i>Microtus pennsylvanicus</i>	<i>Epitedia wenmanni wenmanni</i>	1	4
	<i>Ctenophthalmus pseudagyrtes</i>	3	6
	<i>Megabothris asio asio</i>	1	3
	<i>Ctenophthalmus pseudagyrtes</i>		1
<i>Ondatra zibethicus</i>	<i>Corrodopsylla curvata</i>	1	
<i>Zapus hudsonius</i>	<i>Nearctopsylla genalis laurentina</i>	5	5
<i>Mustela erminea</i>	<i>Hystriehopsylla tahavuaana</i>	1	
	<i>Epitedia wenmanni wenmanni</i>	2	3
	<i>Ctenophthalmus pseudagyrtes</i>	2	6
	<i>Orchopeas howardii</i>		1
	<i>Orchopeas leucopus</i>	1	
	<i>Opisodasys pseudarctomys</i>	1	
	<i>Megabothris asio asio</i>		3

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**Biology of the
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and Vicinity**

PART 1: THE ALGAE

BY

GEORGE JOHN SCHUMACHER

Museum Expert

PART 2: THE SEED PLANTS

BY

STANLEY JAY SMITH

Curator of Botany

**PART 3: THE AMPHIBIANS, REPTILES
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**NEW YORK STATE MUSEUM
AND SCIENCE SERVICE
BULLETIN NUMBER 383**

*The University of the State of New York
The State Education Department*

Albany, N. Y.

January 1961

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*The University of the State of New York
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CONTENTS

	<i>Page</i>
The Algae	5
Seed Plants	19
Cultivated Plants	22
Weeds	26
Native Plants	35
An Ecological Survey of Amphibians, Reptiles and Mammals.....	63
Tables	89

ILLUSTRATION

Figure 1: Map of Allegany Indian Reservation and Vicinity, Cattaraugus County	99
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The Algae of the Allegany Indian Reservation and Vicinity

BY

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Museum Expert

New York State Museum and Science Service

During the summer of 1957, the New York State Museum conducted a survey of the Allegheny River area. This survey involved all the disciplines of the Museum either directly or indirectly and it was proposed that a study of the algae be included. Toward this end a three-week period extending from August 7 through August 28 was spent in that region collecting the necessary samples.

It was evident that the area could be divided into three geographical regions, namely the Allegany State Park, the Allegany Indian Reservation and the immediate surrounding country. Actual collecting stations were located in all three areas and they were selected on a threefold basis; i.e., because of an interesting ecological situation, because of the desirability to visit as many of the tributaries to the Allegheny as possible and to establish stations in various geographical locations. In this manner it was hoped a truly representative series of collections could be obtained. The number of collections made at any one particular station depended solely upon the variety of habitats exhibited by that station and the apparent quality of the algae. A sum total of 188 collections was made during the survey, representing samples from 46 established stations.

The stations established outside the area are included because they are similar in many respects to those stations located within the area, and their individual floras add tremendously to the overall flora. Of lesser importance are the facts that they are only a few miles from the main area and their number is small.

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All collections were placed in glass bottles and examined in the fresh condition upon return to camp. In this manner such preliminary examinations revealed many forms that might otherwise be destroyed or altered due to preservation. All material was ultimately preserved in 5-10 percent formalin and received extensive examinations during the following winter months. All collections have been deposited in the New York State Museum.

DESCRIPTIONS OF STATIONS

1. Small tributary to *Stoddard Creek*. A small, narrow, shallow stream with cold water and rocky bottom. The margins are heavily shaded. Altitude 1,760.*
2. *Frances Brook*. A small brook connecting several beaver ponds. Altitude 1,760.
3. Same location as No. 2 but on south side of Frances Brook Road.
4. *Beaver Pond*. A shallow pond with no marginal cover or shade. Runoff from nearby hillside has caused considerable silting. Altitude 1,690.
5. *Quaker Lake*. An artificially dammed lake situated on Quaker Run. The lake is approximately 300 yards long and 125 yards at its widest point. The western portion is used quite heavily for fishing and swimming. The eastern (inlet) portion is very shallow and muddy. Altitude 1,900.
6. A small *cattail-sphagnum marsh* along south side of A.S.P. No. 3, 0.9 mile west of Quaker Lake. Seepage keeps the area damp and small puddles persist in depressions during periods of drought. Altitude 1,740.
7. *Quaker Run*. Rapidly moving water over rock bottom. Altitude 1,800.
8. *Tunungwant Creek*, Town of Limestone. A large, deep, silted creek supporting a luxuriant growth of *Potomageton*. Altitude 1,400.
9. *Tunungwant Swamp*. A rather extensive swamp that was completely dry during the period of investigation. The only water seen was in small holes and depressions. Altitude 1,400.
10. *Riverside Junction Swamp*. A disappointing location in that very little water was present during August. Altitude 1,400.
11. Small tributary to *Limestone Brook*, immediately west of location No. 8. Extremely muddy due to runoff from nearby cultivated fields. Altitude 1,440.
12. Series of *small pools* and *beaver ponds* along Bay State Brook. Denuded areas surrounding this location have added much silt and the bottoms of the ponds and brooks are covered with soft mud. Altitude 1,640-1,480.
13. *Cain Hollow*. A small, cool stream in wooded area. Altitude 1,440.
14. *Fir Tree Swamp*. Previous investigators have cited this small area as an interesting relic of bygone days. Unfortunately, this investigator was hard put to find any suitable collecting locales in the

*All elevations are expressed in terms of feet above sea level.

"swamp." Moisture of any sort was apparent only in the northern portion of the area in holes left by fallen trees and in the depressions around a few hummocks. Altitude 1,370.

15. *Red House Lake*. A triangular shaped lake with a dam along the western margin. It is shallow and fed from all sides by four tributaries. The lake is used extensively for boating, fishing and swimming. However, most of the shores possess some type of aquatic vascular vegetation. Altitude 1,420.
16. *Cricks Run*. A narrow woodland stream. Altitude 1,380-1,340.
17. *Holt Run*, similar to No. 16. Altitude 1,380.
18. *Allegheny River* at mouth of Quaker Run. Exposed mudflats are in evidence here due to the silt being deposited by Quaker Run. The river itself is shallow and swift at this point. Altitude 1,330.
19. *Wolf Run*. A small stream passing through woodland and farmland. Altitude 1,320.
20. *Wolf Run* at junction of Brown's Hollow. Altitude 1,400.
21. *Island in Allegheny River*. Three miles south of junction of A.S.P. No. 3 with N. Y. 346. A flat sandy oval-shaped island in the middle of the river. Altitude 1,300.
22. *Allegheny River* at Onoville. Altitude 1,280.
23. *Sphagnum bog*, one-quarter mile southwest of the junction of A.S.P. No. 2 and No. 3. Altitude 2,200.
24. *Red House Lake*, collections made along north shore of lake described in item 15.
25. *Beeline Creek*, near eastern end of Red House Lake. Altitude 1,400.
26. *Red House Creek*, at western end of the lake. A narrow and shallow creek with swiftly moving water. Altitude 1,380.
27. *Boyd Creek*, near camp No. 8. A small creek that falls quickly in a short distance. Altitude 1,560.
28. *Boyd Creek*. Altitude 1,550.
29. *Small beaver pond*, 0.9 mile north of Camp Arrowhead. The pond is only 20 yards in diameter and its bottom is covered with a thick layer of silt. Altitude 1,600.
30. *Red Pond*, northwest of Steamburg and east of Blood Road. A large boglike pond that is ringed by heavy growth of shrubs and small trees including *Rhus vernix* L. The water is rich in organic matter and the bottom soft from decaying vegetation. Altitude 1,410.
31. *Abandoned gravel pit*, between N. Y. 17 and the Allegheny River, three-fourths mile west of Red House. An extensive abandoned pit, long and narrow with steep sides. Altitude 1,340.
32. *Randolph Fish Hatchery*. Altitude 1,300.
33. Mouth of *Wolf Run*, where it joins the Allegheny. Altitude 1,327.
34. *Allegheny River* in vicinity of Breed Run. Eastern banks are shored with metal pilings as the river makes a sharp turn. Altitude 1,360.
35. *Allegheny River*, City of Salamanca. Most of the collections from this site were taken along the exposed flats lining the northern shore. Altitude 1,370.
36. *Titus Run*, at Salamanca's southern city limits. A very small, weak stream. Altitude 1,430.
37. *Wet roadside banks*, 0.6 mile south of Carrollton Run. Altitude 1,500.

38. Mouth of *Tunungwant Creek* where it joins the Allegheny River. A broad, deep mouth choked with *Potomageton*. Altitude 1,400.
39. *English Brook*. A small woodland brook with stony bottom. Altitude 1,500.
40. *Bear Springs*, 2.5 miles north of Quaker Run Administration Building. Altitude 1,920.
41. Headwaters of *Stoddard Creek*. Altitude 2,200.
42. *Stoddard Creek*, lower end. In this area the creek's flow becomes slower and the water is exposed to more light and runoff. Altitude 1,440.
43. *Bear Caves*, three-fourths mile north of A.S.P. No. 3 near Stony Brook. Samples taken from trees and logs in the vicinity. Altitude 1,780.
44. *Pool* along stream under Erie Railroad bridge on N. Y. 17. Pool was very sluggish and stagnant. Altitude 1,367.
45. *Farm pond* at junction of N. Y. 242 and N. Y. 17 near East Randolph. Altitude 1,320.
46. *Small pit* just off south side of N. Y. 17. Three-fourths mile west of Red House. The pit is now being used as a dump for unwanted brush. It is 20 feet deep and 50 feet in diameter but at the time it held only a few inches of water. Altitude 1,340.

The foregoing stations may be grouped according to their ecological similarities. The first group is exemplified by Quaker Run—a relatively narrow stream with fast-moving water and a rocky bottom. Most of its course is run through wooded areas and its banks are shallow but straight. Other members of this group would be Stoddard Creek, Cain Hollow, Cricks Run, Holt Run, Wolf Run, Beeline Creek, Red House Creek, Boyd Creek and English Brook; all are found within the boundaries of the State Park. Due to their swiftness, shade and bottom, they support little in the way of plantlife with the exception of diatoms. Typical of their algal content would be *Ulothrix zonata*, *Mougeotia* sp. and *Zygnema* sp.

Group two differs from the preceding in that the streams are slower moving and their waters receive more light. Due to the runoff from the surrounding terrain they are inclined to have silt over the bottom. This class includes Frances Brook, Limestone Brook, Titus Run and, in some respects, Tunungwant Creek. The latter creek is much broader and deeper than the rest but it shares their silted, open characteristics. Such genera as *Oscillatoria*, *Oedogonium* and *Spirogyra* are found here.

The third division has only one member, the Allegheny River. Due to its size, shallowness and general lack of aquatic vegetation it is placed in a class by itself. Attached to stones in the moving water would be found *Cladophora glomerata* and *Stigeoclonium nanum*, while in the tychoplankton and small puddles offshore would be species of *Selenastrum* and *Scenedesmus* and the blue-greens *Aphanocapsa*, *Merismopedia* and *Spirulina*.

The lakes comprise the fourth group. These are relatively large bodies of water, although they are shallow, and are fed and drained by streams. In this area, only Quaker Lake and Red House Lake are in this category. Both of these lakes are artificially dammed along their western margin. Their eastern margins support vegetation common to

marshes. The remaining shores are populated by waterweeds and water-lilies. This type of habitat favors the growth of desmids, especially certain species of *Netrium*, *Closterium* and *Cosmarium*. Other tycho-plankton species are represented by the genus *Scenedesmus*. The presence of species that require hard water, a high nitrogenous content and an above average supply of CO_2 give an indication as to the physical-chemical nature of the lakes. These indicator organisms are *Microcystis aeruginosa*, *Coelosphaerium naegelianum* and, to a lesser degree, *Dinobryon bavaricum*.

The small beaver ponds constitute the fifth group. Most of the ponds in this area are small, rather shallow, heavily silted and have exposed shorelines. The presence of silt on the bottom and in suspension creates a situation that is unfavorable to aquatic vegetation, both vascular and nonvascular. The effect of the animal population on such a situation is evidenced by the presence of the algal plankters *Eudorina* and *Pandorina*. Both are frequenters of hard waters that possess a high amount of nitrogenous materials.

Grouping of the remaining stations would be difficult since they represent a variety of environs such as roadside ditches, pools, pits, moist soil etc. The most noteworthy of these is the acid bog, Red Pond. (An adequate description of this station appears in the preceding list of stations, No. 30). The algal flora of this habitat is marked by the presence of *Batrachospermum ectocarpum* and a desmid population rich in quality. Under such circumstances the blue greens would be poor qualitatively and quantitatively.

ANNOTATED LIST OF ALGAE FOUND IN AREA*

The numbers following the species listing and its habitat denote the station from which the sample was taken and the number of the particular collection in which the species was observed. The station numbers are 1 through 46 and correspond to those used in the section describing the stations. The collection numbers range from 1,500 to 1,689.

Since this is the first attempt to identify the algae of this area to species, all of the reports are new locality records. Actually, little work has been done in New York State on the algae. Therefore, no attempt has been made to claim new records for the State or county since all but the most common forms would represent some type of extension of the known range for the particular species. Instead, it is recommended that interested persons refer to the publications listed at the end of this paper for comparison and further information.

* Excluding diatoms and charas.

Division CHLOROPHYTA**Class CHLOROPHYCEAE****Order VOLVOCALES****1. Volvocaceae**

1. *Gonium pectorale* Mueller. Frequent in tycho plankton. 22-1,615 and 25-1,622.
2. *Gonium sociale* (Duj.) Warming. Rare in tycho plankton. 46-1,635.
3. *Pandorina morum* (Muell.) Bory. Frequent in tycho plankton and widespread in distribution. 4-1,520, 15-1,669, 25-1,622, 26-1,627 and 32-1,642.
4. *Eudorina elegans* Ehrenberg. In association with *Pandorina* in tycho plankton. 4-1,520, 26-1,627.

Order TETRASPORALES**2. Palmellaceae**

5. *Sphaerocystis schroeteri* Chodat. Tycho plankton. 25-1,622.
6. *Gloeocystis vesiculosa* Naegeli. Tycho plankton. 15-1,594.

3. Tetrasporaceae

7. *Tetraspora gelatinosa* (Vauch.) Desvaux. Forming gelatinous masses on bottom in shallow, quiet water. 19-1,608.

Order ULOTRICHALES**4. Ulotrichaceae**

8. *Ulothrix zonata* (Weber & Mohr) Kuetzing. Small bits of green attached to stones in stream. 7-1,527.

5. Schizomeridaceae

9. *Schizomeris leibleinii* Kuetzing. Rare to frequent in tycho plankton. 15-1,552.

Order MICROSPORALES**6. Microsporaceae**

10. *Microspora willeana* Lagerheim. Entangled with *Stigeoclonium*. 3-1,503.

Order CHAETOPHORALES**7. Chaetophoraceae**

11. *Stigeoclonium aestivale* (Hazen) Collins. Small bright green tufts attached to submerged twigs in creek. 3-1,503.
12. *Stigeoclonium nanum* Kuetzing. Attached to submerged aquatics. 22-1,616.
13. *Chaetophora attenuata* Hazen. Green gelatinous beads on submerged wood. 12-1,541.

8. Protococcaceae

14. *Protococcus viridis* C. A. Agardh. Common on bark of trees and logs. 40-1,673; 43-1,681.

Order CLADOPHORALES**9. Cladophoraceae**

15. *Cladophora glomerata* (L.) Kuetzing. Long green tufts on stones in rapids. 18-1,554.
16. *Basycladia chelonum* (Collins) Hoffmann & Tilden. On shell of *Chelydra serpentina*, the snapping turtle. 39-1,671.

Order OEDOGONIALES**10. Oedogoniaceae**

17. *Bulbochaete* sp. Common in many situations. On dead submerged wood, 5-1,537; on submerged aquatics, 24-1,616; in tychoplankton, 15-1,559 and 30-1,639.
18. *Oedogonium* sp. Common in many situations. On submerged aquatics, 4-1,501, 8-1,587, 15-1,551 and 24-1,616; in tychoplankton, 2-1,504, 15-1,670 and 45-1,687.

Order CHLOROCOCCALES**11. Characiaceae**

19. *Characium rostratum* Reinhard. Attached to filaments of *Oedogonium*. 15-1,551.

12. Hydrodictyaceae

20. *Pediastrum boryanum* (Turp.) Meneghini. In shallow puddles, 18-1,582 and 35-1,660; in small pond south of main area, 32-1,642.
21. *Pediastrum boryanum* var. *undulatum* Wille. In small pond south of main area, 32-1,642.
22. *Pediastrum duplex* Meyen. In shallow puddles, 18-1,582.
23. *Pediastrum duplex* var. *clathratum* (A. Braun) Lagerheim. In tychoplankton, 22-1,615; in shallow puddles, 35-1,660.
24. *Pediastrum simplex* (Meyen) Lemmermann. In plankton near dam, 26-1,627.
25. *Pediastrum tetras* (Ehrenb.) Ralfs. One of the most widespread of the plankton green algae, 4-1,520, 15-1,591, 15-1,594, 22-1,615, 25-1,622 and 35-1,660.
26. *Pediastrum tetras* var. *tetraodon* (Corda) Rabenhorst. In scrapings taken from metal pilings, 34-1,659.

13. Coelastraceae

27. *Coelastrum cambricum* Archer. In scrapings taken from metal pilings, 34-1,659; common in small puddles, 35-1,660; tychoplankton, 46-1,635.
28. *Coelastrum microporum* Naegeli. Tychoplankton, 25-1,627.
29. *Coelastrum scabrum* Reinsch. Rare, but excellent coenobes in tychoplankton, 15-1,669.
30. *Coelastrum sphaericum* Naegeli. Tychoplankton, 4-1,520.

14. Oocystaceae

31. *Dictyosphaerium ehrenbergianum* Naegeli. Tychoplankton, 15-1,670 and 46-1,635.
32. *Dictyosphaerium pulchellum* Wood. Tychoplankton, 22-1,615; in shallow puddles, 34-1,660.

33. *Oocystis pusilla* Hansgirg. In shallow quiet water, 19-1,608.
34. *Lagerheimia longiseta* var. *major* G. M. Smith. Cells with chloroplasts in two parietal plates, each with a pyrenoid; setae up to 56μ in length. Rare in tychoplankton, 46-1,635.
35. *Dimorphococcus lunatus* A. Braun. In scrapings taken from metal pilings, 34-1,659.
36. *Ankistrodesmus falcatus* (Corda) Ralfs. Mixed with *Cladophora*, 18-1,554; tychoplankton, 22-1,615 and 46-1,635; in scrapings taken from metal pilings, 34-1,659.
37. *Selenastrum bibraianum* Reinsch. Tychoplankton, 4-1,520 and 22-1,615; mixed with blue-greens along muddy shore margins, 34-1,658.
38. *Selenastrum gracile* Reinsch. In shallow puddles, 35-1,660.
39. *Selenastrum westii* G. M. Smith. Mixed with *Cladophora*, 18-1,554.
40. *Kirchneriella contorta* (Schmidle) Bohlin. Tychoplankton, 22-1,615; in small shallow puddles, 35-1,660.
41. *Tetraëdron regulare* var. *incus* Teiling. Mixed with *Cladophora*, 18-1,554.
42. *Polyedriopsis spinulosa* Schmidle. Frequent in tychoplankton, 22-1,615.

15. Scenedesmaceae

43. *Scenedesmus abundans* var. *longicauda* G. M. Smith. In shallow puddles, 35-1,660.
44. *Scenedesmus acuminatus* (Lag.) Chodat. In shallow puddles, 35-1,660; tychoplankton, 46-1,630.
45. *Scenedesmus acutiformis* Schroeder. Tychoplankton, 25-1,622 and 46-1,635.
46. *Scenedesmus arcuatus* Lemmermann. Tychoplankton, 15-1,594.
47. *Scenedesmus armatus* (Chod.) G. M. Smith. In shallow puddles, 35-1,660.
48. *Scenedesmus bijuga* (Turp.) Lagerheim. Tychoplankton, 15-1,669.
49. *Scenedesmus brasiliensis* Bohlin. Tychoplankton, 15-1,669.
50. *Scenedesmus carinatus* (Lemm.) Chodat. Tychoplankton, 15-1,669.
51. *Scenedesmus dimorphus* (Turp.) Kuetzing. Frequent in tychoplankton, 22-1,615, 25-1,622 and 46-1,635; mixed with *Cladophora*, 18-1,554; in scrapings taken from metal pilings, 34-1,654.
52. *Scenedesmus hystrix* Lagerheim. Tychoplankton, 15-1,670.
53. *Scenedesmus obliquus* (Turp.) Kuetzing. In shallow puddles, 35-1,660.
54. *Scenedesmus opoliensis* P. Richter. Mixed with blue-greens on muddy margins, 34-1,658; tychoplankton, 46-1,630.
55. *Scenedesmus quadricauda* (Turp.) de Brébisson. Tychoplankton, 22-1,615 and 46-1,630.
56. *Scenedesmus quadricauda* var. *longispina* (Chod.) G. M. Smith. In shallow puddles. 35-1,660.
57. *Actinastrum hantzschii* var. *fluvatile* Schroeder. Tychoplankton, rare in 15-1,669, common in 22-1,615; in scrapings taken from metal pilings, 34-1,659.
58. *Crucigenia truncata* G. M. Smith. Rare in tychoplankton, 22-1,615 and 46-1,635.

59. *Micractinium pusillum* Fresenius. Tycho plankton, 22-1,615.
60. *Micractinium pusillum* var. *elegans* G. M. Smith. Rare in scrapings taken from metal pilings, 34-1,659.

Order SIPHONALES

16. Vaucheriaceae

61. *Vaucheria* sp. Floating mat in stream, 41-1,677.

Order ZYGNEMATALES

17. Zygnemataceae

62. *Mougeotia* sp. Common in varied situations, 2-1,504, 3-1,551, 6-1,524, 13-1,580, 16-1,601, 17-1,606, 18-1,597 and 28-1,628.
63. *Spirogyra* sp. Common, 2-1,505, 3-1,509, 4-1,500, 5-1,518, 6-1,516, 10-1,526, 25-1,622, 42-1,680 and 44-1,682.
64. *Zygnema* sp. In scrapings of dam spillway, 5-1,513; floating in backwaters, 16-1,601 and 18-1,597.

18. Mesotaeniaceae

65. *Netrium digitus* (Ehrenb.) Itzigsohn & Roth. One of the most widespread organisms of this order. In scrapings of wet cliff at base of dam, 5-1,515; tycho plankton, 15-1,591, 15-1,670, 24-1,614, 25-1,620 and 30-1,639.
66. *Spirotaenia condensata* de Brébisson. Frequent in tycho plankton, 15-1,594 and 17-1,606.
67. *Spirotaenia trabecula* A. Braun. In sluggish backwater, 13-1,580.

19. Desmidiaceae

68. *Closterium diana* Ehrenberg. Tycho plankton, 15-1,594.
69. *Closterium didymotocum* Corda. One cell seen was extremely large, 740 μ x 35 μ . Tycho plankton, 15-1,591 and 15-1,670.
70. *Closterium incurvum* de Brébisson. Tycho plankton, 15-1,670, 25-1,622 and 26-1,627.
71. *Closterium moniliferum* (Bory) Ehrenberg. Tycho plankton, 15-1,552 and 25-1,622.
72. *Closterium striolatum* Ehrenberg. Tycho plankton, 15-1,594.
73. *Closterium turgidum* Ehrenberg. Tycho plankton, 15-1,591.
74. *Closterium venus* (Kuetz.) de Brébisson. Tycho plankton, 15-1,594.
75. *Penium margaritaceum* (Ehrenb.) de Brébisson. Tycho plankton, 25-1,622.
76. *Pleurotaenium ehrenbergii* var. *granulatum* Ralfs. Apical poles with five tubercles in face view. Rare in tycho plankton, 30-1,639.
77. *Pleurotaenium maximum* (Reinsch) Lundell. Tycho plankton, 15-1,552 and 15-1,670.
78. *Pleurotaenium nodulosum* de Brébisson. Tycho plankton, 4-1,520 and 15-1,594.
79. *Pleurotaenium trabecula* (Ehrenb.) Naegeli. Tycho plankton, 4-1,520 and 25-1,622; in scrapings taken from metal pilings, 34-1,659.
80. *Tetmemorus brebissonii* (Menegh.) Ralfs. Tycho plankton, 30-1,639.

81. *Tetmemorus brebissonii* var. *minor* de Bary. Excellent cells seen, averaging 75μ in length, 19μ in width and 13μ at the isthmus. Frequent in tychoplankton, 30-1,639.
82. *Euastrum abruptum* var. *minor* West & West. Tychoplankton, 15-1,669.
83. *Euastrum didelta* (Turp.) Ralfs. Tychoplankton, 30-1,639.
84. *Euastrum insulare* (Wittr.) Roy. Tychoplankton, 15-1,591 and 15-1,594.
85. *Euastrum verrucosum* Ehrenberg. Frequent in tychoplankton, 25-1,619.
86. *Cosmarium granatum* de Brébisson. Tychoplankton, 4-1,520, 15-1,594, 24-1,614 and 25-1,622.
87. *Cosmarium holmiense* Lundell. Excellent cells in shallow quiet water, 19-1,608.
88. *Cosmarium holmiense* var. *integrum* Lundell. In scrapings of wet cliff at base of dam, 5-1,515.
89. *Cosmarium impressulum* Elfv. Tychoplankton, 15-1,670 and 25-1,622.
90. *Cosmarium margaritatum* (Lund.) Roy & Bissett. Tychoplankton, 15-1,594 and 15-1,670.
91. *Cosmarium ovale* var. *prescottii* Irenée-Marie. Several excellent cells seen; row of granules at isthmus and two rows of granules around edge quite evident. Tychoplankton, 15-1,594.
92. *Cosmarium pachydermum* Lundell. Cell wall 2.5μ in thickness. Tychoplankton, 25-1,620.
93. *Cosmarium polygonum* (Naeg.) Archer. Tychoplankton, 15-1,594.
94. *Cosmarium portianum* Archer. Tychoplankton, 15-1,670 and 24-1,614.
95. *Cosmarium protractum* (Naeg.) de Bary. Tychoplankton, 15-1,669, common in 15-1,670 and 25-1,622.
96. *Cosmarium punctulatum* de Brébisson. Tychoplankton, 25-1,619.
97. *Cosmarium punctulatum* var. *subpunctulatum* (Nordst.) Börgesen. Tychoplankton, 15-1,591 and 15-1,594.
98. *Cosmarium quadratum* Ralfs. In squeezings of sphagnum from inlet, 5-1,529.
99. *Cosmarium regnellii* Wille. Tychoplankton, 15-1,591 and 25-1,619.
100. *Cosmarium sportella* de Brébisson. Tychoplankton, 25-1,619.
101. *Cosmarium subcostatum* Nordstedt. Rare in tychoplankton, 15-1,670.
102. *Cosmarium subreniforme* Nordstedt. Tychoplankton, 25-1,622; in small ponds south of main area, 32-1,642.
103. *Cosmarium subtumidum* Nordstedt. Rare in tychoplankton, 15-1,670.
104. *Arthrodesmus octocornis* Ehrenberg. Rare in tychoplankton, 30-1,639.
105. *Staurostrum alternans* de Brébisson. Tychoplankton, 22-1,616.
106. *Staurostrum arcticon* (Ehrenb.) Lundell. Tychoplankton, 15-1,594.
107. *Staurostrum breviaculeatum* G. M. Smith. Rare in tychoplankton, 30-1,639.

108. *Staurostrum chaetoceras* (Schroeder) G. M. Smith. Frequent in tychoplankton, 22-1,615 and 24-1,616.
109. *Staurostrum cuspidatum* var. *divergens* Nordstedt. Common in tychoplankton, 30-1,639.
110. *Staurostrum denticulatum* (Naeg.) Archer. Tychoplankton, 15-1,594.
111. *Staurostrum furcatum* var. *pisiforme* Turner. Frequent in tychoplankton, 30-1,639.
112. *Staurostrum natator* W. West. In scrapings taken from metal pilings, 34-1,659.
113. *Staurostrum orbiculare* Ralfs. Tychoplankton, 15-1,594.
114. *Staurostrum polymorphum* de Brébisson. Tychoplankton, 15-1,594, 15-1,670 and 25-1,622.
115. *Micrasterias papillifera* de Brébisson. In small depression of sphagnum marsh, 6-1,524.
116. *Micrasterias radiata* Hassall. Tychoplankton, 15-1,594, 15-1,670 and 25-1,622.
117. *Micrasterias truncata* (Corda) de Brébisson. Tychoplankton, 30-1,643.
118. *Micrasterias truncata* var. *semiradiata* Cleve. Rare in tychoplankton, 30-1,639.
119. *Sphaerzosma granulatatum* Roy & Bissett. Tychoplankton, 15-1,594 and 25-1,622.
120. *Hyalotheca dissiliens* (Smith) de Brébisson. In still water of pool, 12-1,577.
121. *Hyalotheca mucosa* (Dillw.) Ehrenberg. In shallow depression, 9-1,538; tychoplankton, 15-1,594, frequent in 15-1,670 and 25-1,622.

Division CHRYSOPHYTA

Class CHRYSOPHYCEAE

Order CHRYSOMONADALES

20. Synuraceae

122. *Synura uvella* Ehrenberg. In small beaver pond, tychoplankton, 3-1,503.

21. Ochromonadaceae

123. *Dinobryon bavaricum* Imhof. Euplankton, 5-1,513.
124. *Dinobryon cylindricum* Imhof. In shallow marginal waters, 30-1,639.

Division PYRRHOPHYTA

Class DINOPHYCEAE

Order PERIDINIALES

22. Glenodiniaceae

125. *Glenodinium palustre* (Lemm.) Schiller. Tychoplankton, 30-1,639.

23. Peridiniaceae

126. *Peridinium cinctum* (Muell.) Ehrenberg. In plankton near dam, 26-1,627.
127. *Peridinium limbatum* (Stokes) Lemmermann. Rare in tychoplankton, 30-1,639.

Division CYANOPHYTA**Class MYXOPHYCEAE****Order CHROOCOCCALES****24. Chroococcaceae**

- 128. *Chroococcus turgidus* (Kuetz.) Naegeli. In small depressions in sphagnum marsh, 6-1,524.
- 129. *Aphanocapsa elachista* West & West. Tycho plankton, 22-1,615 and 46-1,635.
- 130. *Microcystis aeruginosa* Kuetzing. Tycho plankton, 15-1,594, 15-1,670 and 31-1,637.
- 131. *Merismopedia elegans* A. Braun. In floating debris, 27-1,599.
- 132. *Merismopedia glauca* (Ehrenb.) Naegeli. Tycho plankton, 15-1,669 and 22-1,616.
- 133. *Merismopedia punctata* Meyen. In scrapings taken from metal pilings, 34-1,659.
- 134. *Coelosphaerium kuetzingianum* Naegeli. Tycho plankton 31-1,637.
- 135. *Coelosphaerium naegelianum* Unger. Tycho plankton, 15-1,591, 15-1,594 and common in 26-1,627.

Order HORMOGONALES**25. Oscillatoriaceae**

- 136. *Spirulina major* Kuetzing. Very common with other blue-greens on muddy margins, 34-1,658; in scrapings taken from metal pilings, 34-1,659; on bottom and submerged objects, 38-1,668.
- 137. *Oscillatoria formosa* Bory. Common on muddy margins, 34-1,658; in puddles on island, 21-1,612.
- 138. *Oscillatoria limosa* (Roth) C. A. Agardh. Forming brown mats on stones on bottom, 20-1,610; common in shallow puddles, 35-1,660; floating in stream, 41-1,679.
- 139. *Oscillatoria princeps* Vaucher. Tycho plankton, 25-1,622; in shallow puddles, 30-1,660.
- 140. *Oscillatoria sancta* (Kuetz.) Gomont. Entangled with floating mat of *Vaucheria*, 41-1,677.
- 141. *Oscillatoria tenuis* C. A. Agardh. Tycho plankton, 1-1,510 and 45-1,687; on mud, 15-1,669.
- 142. *Oscillatoria tenuis* var. *tergestina* (Kuetz.) Rabenhorst. Common, intermixed with floating debris, 15-1,591.

26. Nostocaceae

- 143. *Anabaena felsii* (Menegh.) Bornet & Flahault. Rare in tycho plankton near dam, 26-1,627.
- 144. *Anabaena flos-aquae* (Lyngb.) de Brébisson. Forming a small bloom about shoreline, 24-1,605; frequent in floating debris, 25-1,620.
- 145. *Aphanizomenon flos-aquae* (L.) Ralfs. Along shore margin and in euplankton, 31-1,629 and 31-1,637.
- 146. *Cylindrospermum minutum* Wood. In scrapings of wet cliff at base of dam, 5-1,515.

27. Stigonemataceae

147. *Hapalosiphon hibernicus* West & West. Entangled with other algae in shallow water on stones and pebbles near dam, 26-1,627.

Division RHODOPHYTA

Class RHODOPHYCEAE

Order NEMALIONALES

28. Batrachospermaceae

148. *Batrachospermum ectocarpum* Sirodot. (?). The absence of reproductive organs makes positive identification of this species impossible. It is tentatively placed in this species because of the habitat and the vegetative characteristics. Frequent in small shallow areas about the margin, attached to submerged roots, 30-1,524 and 30-1,539.

SUMMARY AND CONCLUSIONS

The purpose of this survey was to collect algae from the Allegany State Park, the Allegany Indian Reservation and adjacent areas in order to supply information applicable to the following:

1. A qualitative study of the algae, their distribution throughout the area and their identification to species whenever possible.
2. A comparison of the current findings with those of the 1937 Biological Survey.
3. A prediction of what might happen should the area be flooded. With these points in mind, each will be discussed.

1. Three weeks in the month of August were spent in the field collecting 188 samples from 46 stations. As a result, a total of 148 taxa in 65 genera and 28 families were identified. Those species worthy of special mention because of their relative rareness are *Schizomeris leibleinii*, *Lagerheimia longiseta* var. *major*, *Polyedriopsis spinulosa*, *Scenedesmus carinatus*, *Actinastrum hantzschii* var. *fluvatile*, *Pleurotaenium ehrenbergii* var. *granulatum*, *Cosmarium ovale* var. *prescottii*, *Arthrodesmus octocornis* and *Staurostrum chaetoceras*. *Anabaena flos-aquae* should be mentioned as a cause of a minor bloom in Red House Lake.

The genera represented by the largest number of taxa are as follows: *Cosmarium*, 18; *Scenedesmus*, 14; *Staurostrum*, 10; *Closterium*, 7, and *Pediastrum*, 7. The families with the largest number of taxa are as follows: *Desmidiaceae*, 54; *Scenedesmaceae*, 18; *Oocystaceae*, 12; *Chroococcaceae*, 8, and *Hydrodictyaceae*, 8.

Further qualitative findings and individual distributions are given in the annotated list.

2. An actual comparison of this study with that conducted by the biological survey in 1937 cannot be made for several reasons. The algae mentioned in the 1937 survey were identified only to genus; 38 were listed, and the investigations were limited to Chautauqua Lake—a lake outside the area of this study. Lastly, the previous study was principally limnological rather than taxonomic.

3. From field observations and the material gathered, it is quite evident the Allegheny River is not a productive body of water for algae. This point was made by McVaugh (1937). He stated the growth of vegetation is seriously hindered by the swift-flowing waters and the bottoms covered with "waterworn glacial pebbles." He also noted the scouring action of periodic floods and the effects of pollutions in creating an unfavorable situation. As far as can be seen, all these conditions exist today and, as a result, the species that have managed to establish themselves are those that are extremely hardy and have little value.

For different ecological reasons, mentioned in the station descriptions, the mountain streams are quite barren and unproductive. If flooding of the area should occur, it will be along the river and lower portions of these streams. In such an event, little damage to the algal flora is foreseen, i.e. in amount or variety. If permanent flooding did take place, a condition could develop that would be favorable to the establishment and maintenance of more desirable algae, due to the increase in depth and the decrease in speed of such waters.

It is in the areas that will not be affected by inundation that the interesting algae are found; e.g. Red House Lake, Quaker Lake and Red Pond. If these and their kind are permitted to remain intact it would mean the great majority of the algae in the Allegheny River area would be untouched and allowed to flourish.

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Seed Plants of the Allegany Indian Reservation and Vicinity

Additions and Notes

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INTRODUCTION

The New York State Museum has had a traditional interest in the botany of southern Cattaraugus County, particularly that in and around the Allegany State Park. Several papers on the vascular plants and the vegetation of the area have already been published. This report should be considered as a supplement including the results of more recent explorations.

The present investigator concentrated on the Indian reservation and the oak woods near the Allegheny River. An effort was made to add to our knowledge of escapes and weeds in the area. Since the bulk of the previous botanizing in the region was done by scientists and students connected with the Allegany School of Natural History and their efforts were mostly made in the summer, special trips were made in spring and in autumn. All in all, most of the summer of 1957, a week in the spring of 1957, another in the spring of 1958 and a final week in the autumn of 1958 were spent in the area. In the summer of 1957, the writer was assisted by Paul F. Fendt. On the other trips, he was accompanied by Dr. Stephen W. Eaton, professor of biology, St. Bonaventure University.

The herbarium of the Allegany School of Natural History is now the property of St. Bonaventure University. Members of the staff of the latter institution have collected widely in the area and their specimens have all been made available for study. The writer has personally verified about 90 percent of the sheets in the St. Bonaventure herbarium. In addition, he has studied pertinent collections in the herbarium of the New York State Museum. These include many specimens collected by Dr. Homer D. House, former state botanist, and his colleagues in connection with earlier museum publications on the botany of the area as well as those of the present curator. They also include a set of specimens collected by Dr. William N. Fenton, now Assistant

Commissioner for the State Museum and Science Service, during his investigations on the ethnobotany of the Iroquois in 1938 and 1939. The first set of these specimens is preserved in the ethnobotanical collections of the University Museum of the University of Michigan.

These efforts have uncovered many interesting records which are detailed later. After studying all available published reports, it is concluded that a number of these records are apparently new. Unfortunately, the account of plants about St. Bonaventure by Fr. Hubert Vecchierello (1940-1942) is rather general and the supporting specimens are mostly not in existence. In this situation, the present writer has considered a taxon new to the area covered, unless Fr. Vecchierello cited specific stations for it, which could be pinpointed as within the area. As a result, 35 escapes, 75 weeds and 81 native species or subspecies are added to the list of plants in the region studied. These additions are indicated in the text by asterisks. The following are hitherto unreported from the State:

Escapes

Agrostis gigantea var. *gigantea*

Lespedeza stipulacea

Weeds

Malva rotundifolia

Natives

Carex caroliniana

C. grvida var. *grvida*

C. muricata var. *laricina*

Lilium canadense subsp. *editorum*

Baptisia tinctoria var. *projecta*

Chelone glabra subsp. *clatior*

Nomenclature is in accordance with the International Code (Lanjouw *et al.*, edit., 1956). One of the most noticeable changes is in the designation of a variety or a subspecies for the typical race of the species rather than using the binomial for two things: the species including all its variants and also the typical element of the species after variations are excluded. The typical element is designated by repeating the specific epithet without author-citation.

Synonyms are cited from **Gray's Manual** (Fernald, 1950), the **Illustrated Flora** (Gleason, 1952) and from other works where pertinent. Where the name used is in agreement with either the manual or the flora or both, no other references are given. Where it is different from the name (or author-citation) used in both those works, supporting references are cited or a defense is otherwise made of the chosen name. Where the race discussed is the typical one and no differentiation is noted by those works, a reference is given to support the treatment.

In papers of this kind, the author prefers to use a separate paragraph for each species or major race (one with incipient isolation). He considers these races as subspecies or possible subspecies. No new com-

binations are made, however, and, where a varietal combination is available, he has used that as a paragraph-heading, except in a few cases, where such usage might be misleading. In those cases and where no combination was found, the binomial was used. Minor varieties (without isolation) are sometimes mentioned without separate paragraphs.

The statements on distribution in the area and generally in the State are based on published reports and also on material in the files of the New York State Museum. References to the obvious sources (Eaton *et al.*, 1956; House, 1924; House and Alexander, 1927; House and Gordon, 1940; Jennings, 1953; Muenscher, 1935b; Smith, 1945; Wiegand and Eames, 1926; Zenkert, 1934) are omitted from the catalog but included in the bibliography.

All stations reported in this paper are shown on the map (p. 99) as far as possible. A few localities are outside these limits but may be found on ordinary roadmaps with two exceptions. Tributary No. 49 of the Allegheny River is a small stream entering the river opposite St. Bonaventure. Fivemile Creek enters the river from the north just west of the village of Allegany and just east of the map. A few localities in old reports could not be located on available maps. Two need some explanation. Jones Hill is the same as Roundtop on the map. Waterman Swamp, also known as Owlensburg Bog (and so designated in earlier reports) or Allenburg Bog, is outside the area, on the border of the Towns of Napoli and New Albion.

All specimens cited are in the herbarium of the New York State Museum, unless otherwise noted. Those in the herbarium of St. Bonaventure University are indicated by the abbreviation, St. B, in parenthesis. Specimens are cited by collector's number, if possible, by accession number or (in the absence of either) by date. Names of the three most frequently cited collectors are abbreviated:

Stephen W. Eaton E

Paul F. Fendt F

Stanley J. Smith S

The writer expresses his appreciation to individuals and institutions. St. Bonaventure University made its facilities available at all times. In particular, Professor Eaton was an amiable and interested host and an invaluable guide in the field. Mr. Fendt was a most helpful assistant. Donald M. Lewis, junior scientist, New York State Museum and Science Service, aided greatly in verifying citations in the manuscript. Dr. Eugene C. Ogden, state botanist, identified specimens in the *Potamogeton perfoliatus* complex. Dr. Harold W. Rickett, bibliographer, the New York Botanical Garden, aided in interpreting the International Code. Finally, the officials and various citizens of the Seneca Nation were most cooperative.

I. CULTIVATED PLANTS

Cultivated plants, if really acclimated to an area, tend to escape and become part of the established flora. Two such items, known to all, are the common dandelion, *Taraxacum officinale* Weber, and the field daisy, *Chrysanthemum leucanthemum* L. More recently, the sweet rocket, *Hesperis matronalis* L., has successfully colonized large areas of the State. There are many others. As noted in an earlier paper (Smith, 1945), records of such establishment are not common. The following notes add to knowledge of this problem in the Allegheny Valley in New York State.

Three elements are involved in the appearance of cultivated plants as spontaneous items in the area under consideration. One is escape from field, lawn, garden or park where cultivated by white people or by others under their cultural influence. This accounts for the bulk of the taxa. A second is the appearance of annuals, particularly cereal-grasses, about railroad yards where the seeds are apparently swept out of freight cars. These same grasses are occasionally spontaneous along roads and elsewhere. The third element is persistence or establishment after cultivation by the Indians. A notable example in this instance is the manroot, *Ipomoea pandurata* (L.) G. F. W. Meyer (House & Gordon, 1940). Another is the germander speedwell, *Veronica chamaedrys* L., which was planted by the Seneca Indian gardeners for its handsome blue flowers. If the plant in question is native in a region far removed from ours, the problem is not difficult. Where it is slightly out of range, it is a much harder matter to decide. Unproven cases are mentioned under the various species in the section on native plants.

* *Agrostis gigantea* Roth var. *gigantea* (var. *ramosa* Philipson, 1937). Waste places; rare. Along the railroad at Limestone, S & F 23171. This is the first specimen from New York State seen by the writer. The var. *dispar* (Mx.) Philipson (*A. alba* auct.; *A. stolonifera* var. *major*) is common.

* *A. tenuis* Sibth. Open areas; a local introduction. Grounds of abandoned nursery, east side of Salamanca, S & F 23466.

* *Alopecurus pratensis* L. Moist low grounds; occasional. Across river from St. Bonaventure, S et al. (St. B 3155); observed in Fox Hollow, at Killbuck and on the north side of Salamanca. New to southwestern New York and not reported from western Pennsylvania. Apparently overlooked because of early flowering or confusion with *Phleum pratense* L.

Arrhenatherum elatius (L.) Mert. & Koch. Roadsides; becoming common, as elsewhere in the State. Observed at the following stations: Limestone, west side of Allegany, north of Carrollton, Salamanca, north of Steamburg. Reported only from the vicinity of Allegany Park Rock City.

Bromus inermis Leyss. subsp. *inermis* (Wagnon, 1950). Roadsides and fields; increasing, as in other areas. To the station on Jones Hill

* Indicates additions to earlier local lists.

may be added the following observed localities: lower Quaker Run, east of Blacksnake Mountain, Cain Hollow, Killbuck.

* *Hordeum vulgare* L. Railroad yards; occasional. Observed at Allegany.

* *Lolium multiflorum* Lam. Waste places; occasional. Gravel along brook, west side of Allegany, *S & F* 23631. This species may be expected anywhere because of its frequent use in grass-mixtures.

* *Panicum milaceum* L. Cultivated places; rare. St. Bonaventure, *Vecchierello*, Sept. 8, 1943.

* *Secale cereale* L. Railroad yards; occasional. Allegany, *S & F* 23687, 24999.

* *Setaria italica* (L.) PB. Cultivated places and railroad banks. St. Bonaventure, *Vecchierello*, Sept. 8, 1943; Quaker Bridge, *Saunders*, July 18, 1939.

* *Sorghum sudanense* (Piper) Stapf (*S. vulgare* var. *sudanense*; *S. vulgare*, *p. p.*, of Fernald, 1950 and Gleason, 1952). Roadsides; occasional. West of Steamburg, *S et al.* 24465. Despite the marked difference in appearance, the investigator would prefer to recognize this as part of the comprehensive species, previously called *S. vulgare* Pers. (*cf.* Karper & Chisholm, 1936). That name, unfortunately, is invalid (Shinners, 1956) and the writer has not located a combination. Pending such combination, he is following Pohl (1947) and Chase (1950).

* *Triticum aestivum* L. Railroads; a frequent casual. Limestone, *S & F* 23166; Allegany, *S & F* 23686; observed at Horseshoe, Quaker Bridge and Elko.

* *Zea mays* L. Roadsides and along railroads; occasional. Observed at Allegany, south of Peth and west of Steamburg.

Acorus calamus L. Swales and moist fields; more frequent than reported. Cricks Run, *Fenton* 89; observed west of Vandalia, north of Riverside Junction and at Killbuck. Reported, heretofore, only from Quaker Run.

* *Asparagus officinalis* L. subsp. *officinalis* (Clapham *et al.*, 1952). Roadsides; rare (?). Observed south of Peth.

Hemerocallis fulva (L.) L. (*cf.* synonymy in House, 1924). Occasional. An observation along lower Quaker Run at the mouth of Cain Hollow places it definitely in the park.

* *Ornithogalum umbellatum* L. Rare. Ditch near abandoned housesite, north side of Salamanca, *S & E* 26517.

* *Populus* × *gileadensis* Rouleau (*P. candicans* *auct.*). Low grounds; occasional. Several trees along the river, west of Allegany, *S & E* 24983; *E et al.*, May 20, 1958 (St. B).

* *Salix fragilis* L. Low grounds; at least locally common. Common about the oxbow, Horseshoe, *S et al.* 26399. Probably elsewhere.

* *Betula pendula* Roth (*B. alba*, *auct.*). Along railroads; occasional. Allegany, across Route 17 from St. Bonaventure, where there are several old planted trees, *S* 23659, 24993; Carrollton, *S & F* 23406, 23407. There are only a few records for the State.

* *Ranunculus repens* L. Ditches; rare. Cold Spring, *S & E* 24958 — *f. pleniflorus* (Fern.) House (House, 1924). Occasional in the State.

* *Berberis thunbergii* DC. Waste places, woods and thickets; occasional. St. Bonaventure, *E et al.* (St. B 1344); railroad yards, Allegany.

S & F 23632; observed in wet woods at Riverside Junction. Spreading in the State.

* ***B. vulgaris*** L. Old fields; occasional. Mountainside, St. Bonaventure, *Vecchierello*, Sept. 15, 1922.

* ***Fumaria officinalis*** L. Flowerbeds, etc.; occasional. St. Bonaventure, *anon.* (St. B 1386). Local in the State.

* ***Brassica napobrassica*** Mill. Railroad yards; occasional. Allegany, *S & F* 23638. The Rutabaga seems never to have become established in this State.

Hesperis matronalis L. Riverbottom woods; becoming common as elsewhere across the State. River islands below Red House, *S et al.* 23586; observed at Olean and Salamanca. Reported from the mouth of Fivemile Hollow (*Vecchierello*, 1940—42).

* ***Lunaria annua*** L. In shrubbery; occasional. St. Bonaventure, *M. F. Way* (St. B 1417). Only a few records for the State.

Nasturtium officinale R. Br. (*N. Nasturtium-aquaticum*). A second station: Allegany, *anon.* (St. B 1396).

* ***Raphanus sativus*** L. Railroad yards and roadsides; occasional. Near Ninemile, *E* (St. B 3103, 3104); observed at Allegany.

* ***Ribes sativum*** (Reichb.) Syme (*cf.* synonymy in Berger, 1924). Occasional near old houses and elsewhere. Limestone, *S et al.* 23522; open oak woods, Killbuck, *S & E* 26476; 1 mile southwest of Peth, *E et al.* (St. B 1468); observed at Salamanca. Compare the author's previous discussion (Smith, 1945).

* ***Lespedeza stipulacea*** Maxim. Railroad yards; occasional. Allegany, *S & F* 23658, 24299. Not found in flower, but the habit, texture of leaflets, prominent scarious stipules, markedly petiolate leaves and antorsely pubescent stems all indicate this species (*cf.* Isely, 1948). Only a few stations in New York State, for which the investigator has seen no published records.

* ***Lotus corniculatus*** L. Appearing as a roadside plant; scarce, as yet. North of Steamburg, *S & F* 23223; observed near Mount Moriah.

* ***Vicia villosa*** Roth. Waste places; rare. Allegany, *anon.* (St. B 1672) (as *V. cracca*). Locally common in the State.

* ***Linum usitatissimum*** L. Railroad yards; occasional. Allegany, *S & F* 23644. The common flax is not infrequent along railroads; it seems never to have become established.

* ***Anethum graveolens*** L. Roadsides, etc.; occasional. St. Bonaventure, *E* (St. B 2402); Steamburg, *S et al.* 23730.

* ***Ipomoea purpurea*** (L.) Roth. Railroad yards; occasional. Allegany, *S & F* 23676. Several scattered stations across the State. It is difficult to determine whether this should be considered as an escape from cultivation or as a casual weed.

* ***Ajuga reptans*** L. Rare. A single plant in a low pasture, Tenmile Creek, *S & E* 24935. The species is making large colonies in other places in this small valley, spreading from plantings.

Veronica chamaedrys L. Ditches, roadside banks, lawns, etc.; frequent. Horseshoe, *S et al.* 23473; Salamanca, *S & E* 24951; south of Cold Spring, *S & E* 24959; observed at Riverside Junction, Killbuck and Frecks. Previously reported from Bee Hunter Run and English Run.

* **V. filiformis** Sm. Lawns; rare. Salamanca, S & E 24950. Local in the State (Muenscher, 1949).

* **Lonicera morrowii** Gray. Roadsides; occasional. Allegany, S 26252; observed at South Vandalia. Increasing in the State.

* **L. tatarica** L. Roadsides and streambanks; occasional. Observed at Allegany and Horseshoe. An old favorite, locally frequent in the State.

Artemisia absinthium L. Railroad yards; occasional. Allegany, S & F 23650. Reported from a pasture north of Randolph. Several stations in the State, but still local.

Bellis perennis L. Lawns; frequent. Allegany, *anon.* (St. B 2723); Salamanca, S & E 24949; observed at Frecks and Olean; reported from St. Bonaventure. Fernald's listing of this (1950) as an unnumbered genus and calling it merely an escape from cultivation does not accord with its frequency as a lawn weed at lower elevations in many parts of this State. It is even a question, in the author's mind, whether this "small-flowered" strain might not better be considered as definitely introduced as a weed, rather than as an escape.

* **Coreopsis grandiflora** Hogg. Spreading from cultivation; rare. Abundantly seeded on site of old nursery, east of Salamanca, S & F 23463. By comparison, plants of the Chinese balloonflower, *Platycodon grandiflorum* (Jacq.) DC., were thriving but were still in abandoned rows. There are only a few scattered stations for *C. grandiflora* in this State.

Helianthus tuberosus L. Weedy in low cultivated fields; local. Oldtown, S *et al.* 23493. Observed at Horseshoe and Quaker Bridge. The writer believes this was unquestionably introduced by the Iroquois. Hitherto reported only from Elko.

Inula helenium L. Wet old fields; local. Observed 0.7 mile east of Vandalia. Previously reported only from Randolph.

II. WEEDS

In the study of the floristics of any area, a consideration of the weed population is important. Some weeds never become established; others, once they have appeared in a region, spread rapidly. Some will out-compete most natives in the same general habitat. No representatives of the last category have yet been found in the Allegheny area. The assignment of the various taxa to the other two classifications is evident from the records cited.

Many weeds invade an area after disturbance of the native flora through cultivation and construction. With regard to certain species, one wonders whether they were originally native or whether they came into New York State through Indian agency. One such possibility is *Panicum capillare*, witchgrass. This problem will be difficult to solve, if not impossible, because of the scarcity of specimens of early date.

A number of these weeds are reported only from the railroad yards at Allegheny. They are doubtless also at many other spots along railroads and are indicative of a major source of introduction of weed species. Since most of the seeds of these species originally arrived in the area in shipments of grain, feed and other produce, they are also undoubtedly appearing on chicken farms and in garden patches in the general area.

Potamogeton crispus L. Ponds, sloughs, etc.; local. Observed at East Randolph. Previously reported from the vicinity of Quaker Bridge and from a gravelpit between Red House and Cold Spring. Considered locally abundant in the watershed (McVaugh, 1938).

Aristida dichotoma Mx. A rare weed of railroad yards and sidings. Carrollton, S & F 23442, 24501; Allegheny, S & F 23681. No specimens have been found to support the earlier report by Saunders (*cf.* House & Alexander, 1927). Not otherwise listed from western New York; occasional in western Pennsylvania.

* **Avena fatua** L. Railroad yards; rare. Allegheny, S & F 23688, 23689. The specific distinctness of this species and *A. sativa* L. is doubtful. The distinguishing characters (stoutness and geniculation of the awn and heaviness and coloration of the beard—*cf.* Chase, 1950) are all variable and not well correlated.

* **Bromus commutatus** Schrad. (*B. racemosus*, *p. p.*, of Gleason—1952). Weedy places; occasional. Allegheny, S & F 24317; across the river from St. Bonaventure, S *et al.* (St. B 3143); observed north of Steamburg and in the Conewango Valley. Frequent in the State.

* **B. japonicus** Thunb. Railroad yards; occasional. Allegheny, S & F 23682; Salamanca, S & F 23184. This chess is either spreading rapidly in the State or has been overlooked in confusion with related species. It is found along roads and railroads in many parts of the State.

* **B. mollis** L. (*B. hordeaceus* *auct.*). Railroads; rare. Quaker Bridge, S *et al.* 22725. Local in the State.

* **B. tectorum** L. Railroads and roadsides; frequent as elsewhere in the State. Allegheny, S & F 23684; S & E 24998. Observed north of Carrollton, at Salamanca and west of Red House.

* **Calamagrostis epigejos** (L.) Roth. Waste areas; rare. Near Salamanca, *Vecchierello*, August, 1943; east side of Salamanca, *S & F* 23798 (probably the same station). It is reported from Long Island and Saratoga County (Chase, 1950) and a colony has been seen in Putnam County.

* **Eleusine indica** (L.) Gaertn. Railroad yards and curbings; occasional. Allegany, *S & F* 24322; St. Bonaventure, *E* (St. B 3178). Frequent about cities and villages.

* **Elymus canadensis** L. Railroad yards; occasional. A large patch along the railroad, west of Allegany, *S & F* 23629; two fruiting culms in railroad yards, Allegany, *S & F* 23685. This is apparently new to the area, the earlier reports referring to *E. wiegandii* Fern. (p. 37). Not uncommon in the State as a native of dry habitats; local as a weed along railroads.

Eragrostis cilianensis (All.) Link (*E. megastachya*). Waste places; local. Observed at Allegany. Previously reported only from Salamanca.

E. multicaulis Steud. (*E. peregrina*; *E. pilosa*, p. p., of Gleason, 1952). Becoming frequent along railroads as in other areas, outside the mountains. Vicinity of Limestone, *S & F* 23175; Allegany, *S & F* 24320, 27999; Horseshoe, *S et al.* 27794; Salamanca, *S & F* 23185; observed at mouth of Tenmile Creek. The original report was from Quaker Bridge and there is a specimen labeled "Allegheny River, Allegany State Park," *Kenoyer* 9.

E. pectinacea (Mx.) Nees. An even commoner weed of roadsides and railroads. Vicinity of Limestone, *S & F* 23174; St. Bonaventure, *E* (St. B 3179); Allegany, *S & F* 23692, 24319; 2 miles east of Red House, *S* 23575; west of Steamburg, *S & Schumacher* 24362; Oldtown, *S et al.* 24482; observed at mouth of Tenmile Creek, Horseshoe and Steamburg. Previously reported only from East Randolph.

* **E. pilosa** (L.) PB. Roadsides; rare and local. Roadside, mouth of Tenmile Creek, *S & Ketchledge* 25837. The only other record from western New York State is from Collins, Erie County, *Perkins* 403; the species is rare in south central New York, the Hudson Valley and outer Long Island, but a number of collections are known from the vicinity of New York City. The citation by House and Gordon (1940) is in error, the specimen being *E. multicaulis* (*E. peregrina*) as originally reported by House and Alexander (1927).

E. poides PB. Roadsides and railroads; becoming common here as elsewhere. Allegany, *S & F* 23693, 24321; Horseshoe, *S et al.* 23474; west of Steamburg, *S & Schumacher* 24363; observed at Steamburg. Previously reported only from Elko and the vicinity of Peth.

Festuca capillata Lam. (*F. ovina* var. *capillata*) Railroads; occasional. Red House, *S & F* 23182. Reported as chiefly on the higher ridges of the park area.

Hordeum jubatum L. Waste places; rare. Allegany, *anon.* (St. B 450). Reported from Salamanca. Observed by the writer in railroad yards at both places. Occasional to locally common in many parts of the State, but not persisting long.

* **Panicum dichotomiflorum** Mx. (incl. var. *geniculatum*—*cf.* Pohl, 1947). Weedy in railroad yards and along roads; becoming frequent. Allegany, *S & F* 24324; Tenmile Hollow, *E* (St. B 3175); west of

Steamburg, *S & Schumacher* 24366; observed at Killbuck and the mouth of Tenmile Creek. Also on gravelbars, where possibly native: Oldtown, *S et al.* 24486; observed at Horseshoe.

* ***P. virgatum*** L. var. ***spissum*** Linder. Railroads and roadsides; rare. Along railroad, west of Red House, *S & F* 23783. A second collection, *S & F* 23782, is transitional to var. *virgatum*. The species is reported from one mile north of Salamanca, *Alexander*, August 14, 1935. A collection by Alexander on that date, but labeled "near Red House," is in the State Museum; it has no basal parts. A duplicate (St. B 497) has long scaly rhizomes and is good var. *virgatum*. The relationship of the varieties is very intricate, being complicated by polyploidy (Nielson—1945). Var. *spissum* is frequent in southeastern New York, particularly on Long Island, and is a frequent weed north to the vicinity of Albany and occasional elsewhere, mostly about railroads and in open, dry ground. Var. *virgatum* seems to be a scarce native in marshy areas in western New York and locally east to the central Hudson Valley and Lake George; it is rarely found as a weed.

Phalaris canariensis L. Waste places and cultivated garden beds; occasional. St. Bonaventure, *Vecchierello*, Sept. 8, 1943. Previously reported from east of Salamanca.

Poa compressa L. Waste places and cultivated areas; frequent. House and Alexander consider this "not common," but it was observed at many stations, apparently never making large colonies.

P. nemoralis L. Low woods; rare. Across river from St. Bonaventure, *S et al.* (St. B 3145); *E* (St. B 3140). Previously reported only from "east of the Park area," from which this station is also recorded.

* ***P. trivialis*** L. Swampy woods and along streams; infrequent. Riverside Junction, *S et al.* 23134; observed east of Vandalia, below Red House and at Frecks. Locally frequent in the State.

* ***Setaria faberi*** Herrm. Railroad yards; local as yet. Allegany, *S & F* 24326. Common in southeastern New York and north to Albany, spreading rapidly; occasional in central and western New York, to date.

* ***Sporobolus neglectus*** Nash. Railroad yards; rare. Allegany, *S & F* 24323.

* ***S. vaginiflorus*** (Torr.) Wood. Roadsides and railroad yards; becoming frequent. Mouth of Tenmile Creek, *S & Ketchledge* 25838; Riverside Junction, *S & F* 24505; Killbuck, *S & Ketchledge* 27733; East Randolph, *S et al.* 24462; observed at Oldtown. The first number cited is referable to var. *vaginiflorus*; all others belong to var. *inaequalis* Fern. Var. *vaginiflorus* is much more restricted in range in this State, but there seems to be no distinctive isolation. Both this species and the last frequently occur in waste places and seem to be increasing; the exact area of native occurrence, if any, in this State is extremely difficult to determine.

* ***Bulbostylis capillaris*** (L.) C. B. Clarke. Railroads; probably frequent. Allegany, *S & F* 23679; Carrollton, *S & F* 23425; Salamanca, *S & F* 24329; Red House, *S & F* 23180. This species ought to be found along railroads throughout western New York (*cf.* Smith, 1945), but there are only two other stations known to the author from

west of Keuka Lake: Lime Rock, Genesee County, *Watthews* 5295; Medina, Orleans County (observed by the writer).

* **Allium vineale** L. Railroad yards; rare. Allegany, *S* 24994. This species was reported from Limestone, but the specimen is *A. canadense* L. Locally abundant in the State.

* **Epipactis helleborine** (L.) Crantz (*E. latifolia*). Rare in the region to date. Observed at Riverside Junction. Stations cited by Eaton *et al.* (1956) are from outside the area.

Polygonum convolvulus L. Railroad yards, gravelbars, etc.; a few more stations. Allegany, *S* & *F* 23662; observed at Carrollton and on the islands below Red House. Common in the State.

* **P. lapathifolium** L. var. **prostratum** Wimmer. Railroad yards; rare. Allegany, *S* & *F* 23663. Locally frequent in the State about railroads and curbings. This taxon, with its short, broad, blunt leaves, strikingly blotched with dark purple, its stubby inflorescences and sprawling growth, is easily distinguished. The writer has no idea what its value as a major race may be.

Rumex crispus L. Common, as elsewhere in the State. Southern Ninemile Creek, *E* (St. B 3077, *p. p.*); Elko, *S et al.* 22776; observed at seven other stations.

* **R. triangulivalvis** (Danser) Rech. f. (*R. mexicanus auct.*, at least for the most part—Rechinger, f., 1937). Railroad yards; occasional. Observed at Allegany. Becoming frequent in the State. This species might be treated as a subspecies of *R. mexicanus* Meisn., to which it is closely allied.

Chenopodium gigantospermum Aellen (*C. hybridum auct. amer.*—Wahl, 1954). Waste places; rare. Allegany, *S* & *F* 24311. Previously reported only from the grounds of the Allegany School of Natural History. This species is native to New York but frequently appears as weedy.

* **Kochia scoparia** (L.) Schrad. Railroad yards; rare. Allegany, *S* & *F* 23670, 24312. Occasional to frequent in this habitat in the State; becoming abundant on the sandplains west of Albany.

* **Salsola kali** L. var. **tenuifolia** G. F. W. Meyer. Railroad yards; rare. Allegany, *S* & *F* 23671. Becoming frequent along railroads and in waste places at lower elevations in the State.

* **Amaranthus albus** L. Waste places; occasional. Allegany, *S* & *F* 23667; Limestone, *S* & *F* 23150.

* **A. hybridus** L. Railroad yards; occasional. Allegany, *S* & *F* 24302, 24303.

* **A. powellii** Wats. Railroad yards; occasional. Allegany, *S* & *F* 23665, 23666. These three species, or at least the first two, are probably frequent in cultivated fields and gardens, but no other observations were made. The first two are common in many parts of the State and the third is locally so.

* **A. tamariscinus** Nutt. (*Acnida tamariscina*—Sauer, 1955). Railroad yards; rare. Allegany, *S* & *F* 24306 (pistillate), 24304, 24305, 24307, 24308, 24309, 24310 (staminate). The staminate plants were variable in appearance, but all had the bracts and outer perianth-segments prominently nerved and spinose-tipped and the bracts half as long

as the perianths. The species is becoming frequent in railroad yards in several cities of the State.

* **Mirabilis nyctaginea** (Mx.) MacM. (*Oxybaphus nyctagineus*). Railroad yards; rare. A single plant, Allegany, *S & F* 24295. Otherwise becoming common in the State at low elevations.

Portulaca oleracea L. Waste places; probably frequent. Railroad yards, Allegany, *S & F* 23661; Cold Spring, *Fenton* 205. The only previous reports were from Quaker Bridge and St. Bonaventure. Common in the State.

* **Arenaria serpyllifolia** L. Along railroads; probably frequent. Observed at Allegany and at Elko. Common in the State.

* **Sagina procumbens** L. Railroad yards; rare. Salamanca, *S & F* 24328. Occasional to frequent at lower elevations in the State, although once considered infrequent to rare; Warren County, Pa.

Silene cucubalus Wibel (*S. latifolia*). Waste places; increasing. Allegany, *anon.* (St. B 1256); *S & F* 24300. Becoming common in many parts of the State.

* **Vaccaria segetalis** (Neck.) Garcke (*Saponaria vaccaria*). Railroad yards; occasional. Allegany, *S & F* 24301. Occasional in the State as well.

Ranunculus repens L. Ditches, sloughs and gravelbars; probably frequent. Horseshoe, *S & E* 26357, 26359; river islands below Red House, *S & E* 23585; observed about Vandalia and in Tenmile Hollow. No. 26357 is referable to var. *glabratus* DC., and the handsome sterile f. *pleni florus* (Fern.). House is also present (p. 23). Reported from St. Bonaventure. Infrequent in the State.

Alliaria officinalis Andrz. Wooded banks; rare. Salamanca, *S & F* 24327; *S & E* 26523. Reported from St. Bonaventure. Spreading in the State.

* **Arabis glabra** (L.) Bernh. Roadsides; rare. Roadside, Allegany State Park, *Gordon* (St. B 1409). Previously reported as the native *A. drummondii* Gray.

Brassica juncea (L.) Coss. Railroads; occasional. Allegany, *S* 23637; *S & F* 24292; Limestone, *S & F* 23144. Reported only from Quaker Bridge.

* **Camelina microcarpa** Andrz. Railroad yards; occasional. Allegany, *S & F* 24987. Becoming frequent in central and western New York.

* **Cardamine pratensis** L. subsp. *pratensis* (subsp. *typica* Clausen, 1949). Lawns and alluvial woods; becoming frequent. St. Bonaventure, *E et al.* (St. B 1407); Horseshoe, *S & E* 26365; Salamanca, *S & E* 24948; lakeshore, Allegany State Park, *Yackovich et al.* (St. B 1406); observed west of Allegany. Becoming frequent in many parts of the State.

* **Descurainia sophia** (L.) Webb. Railroad yards; occasional. Allegany, *S & F* 23635, 24290; *S* 24986. Increasing in the State.

* **Erucastrum gallicum** (Willd.) O. E. Schultz. Railroad yards; occasional. Allegany, *S & F* 23636, 24291. Increasing in many parts of the State.

* **Erysimum repandum** L. Railroad yards; occasional. Allegany, *S* 24985. Rare in the State.

* **Lepidium perfoliatum** L. Railroad yards; occasional. Allegany, *S & F* 23640. Also rare in the State.

* **L. virginicum** L. var. **virginicum**. Railroads and roadsides; probably frequent. St. Bonaventure, *E* (St. B 3102); southern Ninemile, *E* (St. B 3101). Common in many parts of the State.

* **Raphanus raphanistrum** L. Roadsides and gravelbars; spreading as elsewhere. North of Cold Spring, *S et al.* 23785; west of Steamburg, *S & Schumacher* 24361; observed both east and west of Red House and on the islands downriver. Becoming a pest in some parts of the State.

* **Rorippa sylvestris** (L.) Bess. Rivershores; becoming frequent as elsewhere in the State. Carrollton, *S & F* 23382; river islands below Red House, *S et al.* 23588; Quaker Bridge, *S & F* 23479; observed at Riverside Junction, Horseshoe, Killbuck and north of Wolf Run.

* **Thlaspi arvense** L. Along railroads and in abandoned garden plots; scarce. Allegany, *S & F* 23639; *S & E* 24989; Tenmile Road, *E* (St. B 3106, 3107); Quaker Bridge, *Alexander & House* 12828a. Appearing in many parts of the State.

* **Polanisia dodecandra** (L.) DC. subsp. **dodecandra** (*P. graveolens*—Iltis, 1958). Weed in gardens; rare. St. Bonaventure, *Vecchierello* (St. B 1387). Local in the State; in part, native.

Sedum triphyllum (Haw.) S. F. Gray (*S. purpureum*; *S. telephium* of Gleason, 1952). Occasional in waste places. Elko, *S et al.* 22762; observed at Carrollton, Horseshoe and mouth of State Line Run. Previously reported only from Holts Run. The writer is accepting the nomenclature of Clausen (1949), who is monographing the genus.

* **Potentilla argentea** L. Waste places; rare (?). Allegany, *anon.* (St. B 1540). Not observed by the writer or previously reported. Frequent in many parts of the State.

P. recta L. Waste places and fields; increasing. Observed at Allegany, Carrollton and opposite Red House. Locally abundant at lower elevations in the State.

* **Cassia fasciculata** Mx. Railroad yards; occasional. Allegany, *S & F* 23657. This species is locally frequent as a native in southeastern New York, but rare elsewhere in the State.

Melilotus albus Desr. Waste places; infrequent. Allegany, *anon.* (St. B 1691); observed at Carrollton and south of Peth. Originally reported only from north of Quaker Bridge.

* **M. altissimus** Thuill. Railroads; rare. Salamanca, *Alexander* (St. B 1643). This was originally reported as *M. officinalis*. Infrequent in the State.

* **M. officinalis** (L.) Desr. Railroad yards; rare. Observed at Allegany. Distinctive in its corrugated fruits. The statewide distribution of these two yellow-flowered sweet clovers is poorly known, because of confusion between them.

* **Strophostyles helvola** (L.) Ell. Railroad yards; rare. A single plant of this characteristic species with lobed leaflets was observed at Allegany, but it was destroyed before reaching proper stage for collecting. A frequent native along the coast, along the lower Hudson River and about the Great Lakes.

* **Vicia cracca** L. Railroad yards; rare. Observed at Allegany. Locally frequent in many parts of the State. Reported from Quaker Bridge, but the specimen, while of doubtful identity, is not this species.

* **Geranium pusillum** L. Flowerbeds; rare. St. Bonaventure, *S & E* 26254. Gradually increasing in the State. It should be mentioned here that small plants of a species of cranesbill with neither flowers nor fruits were collected (*S et al.* 23492, 23793) or observed on several occasions in a cornfield at Oldtown. This investigator suspects them of being the native *Geranium carolinianum* L. var. *confertiflorum* Fern., which has been found in similar habitats in Chemung County.

Polygala sanguinea L. (*P. viridescens*). Fields and roadside banks; scarce. Mouth of Tenmile Creek, *S & Ketchledge* 25835; Horse-shoe, *S et al.* 27747. Previously reported only from Butler's Run. The specimen from Portville, east of the map area, cited as *P. incarnata* L., also belongs here. Becoming increasingly common in the State.

* **Abutilon theophrasti** Medic. Railroad yards; occasional. Allegany, *S & F* 23643. Becoming frequent in cultivated fields throughout much of the State.

Hibiscus trionum L. Waste places; occasional. Allegany, *anon.* (St. B 1837, 1838); *S & F* 23642. Reported from St. Bonaventure. Increasing in the State, but local.

* **Malva rotundifolia** L. Railroad yards; rare. Allegany, *S & F* 24296. This is the first specimen the writer has identified from New York State, although the species may have been overlooked or not separated from the common *M. neglecta* Wallr., which long passed as *M. rotundifolia*.

Viola arvensis Murr. Fields and waste places; increasing. Hills, Allegany, *anon.* (St. B 1920); railroad yards, Allegany, *S* 24991. Reported from the vicinity of Vandalia and Steamburg.

* **Oenothera laciniata** Hill var. *laciniata*. Railroad yards; occasional. Allegany, *S & F* 24294. Scattered stations about the State. Apparently native just west of area.

* **Convolvulus arvensis** L. Railroad yards; rare. Observed at Allegany. Locally abundant in the State.

* **Ipomoea hederacea** Jacq. Railroad yards; occasional. Allegany, *S & F* 23677. Known from a few stations across the State.

* **Echium vulgare** L. Railroad yards and waste places; occasional. Allegany, *S & F* 23672; head of Fivemile Road, *E & Liegey*, Oct. 23, 1956 (St. B). The scarcity of lime may account for the rarity of this species in the area.

* **Verbena bracteata** Lag. & Rodr. Railroad yards; occasional. Allegany, *S & F* 23678. Rare in the State, but known from several counties.

* **Datura stramonium** L. Railroad yards; occasional. Allegany, *S & F* 23674, 24313. Infrequent in the State, but known practically throughout the lowlands.

Solanum americanum Mill. (*Solanum nigrum auct.*, p. p.). Rare as a native and rare as a weed. Railroad yards, Allegany, *S & F* 24314. Infrequent in the State.

* **S. rostratum** Dunal. Railroad yards; occasional. Allegany, *S & F* 23675, 24315. Occasional in many parts of the State.

* **Veronica anagallis-aquatica** L. subsp. **anagallis-aquatica** (Hultén, 1958). Muddy shores; rare as yet. Horseshoe, *S & E* 26414; East Randolph, *S et al.* 24452. Not listed from the watershed (McVaugh, 1938). Becoming frequent in the lowlands of the State.

* **V. arvensis** L. Old fields, roadsides and lawns; probably frequent. St. Bonaventure, *S & E* 24859; observed at Frecks. Frequent in the State, outside of the mountains.

V. peregrina L. subsp. **peregrina** (subsp. *typica* Pennell, 1935). Lawns and waste places; probably frequent, but overlooked. St. Bonaventure, *S & E* 24858, 24940; observed at Frecks. Previously reported only from grounds of the Allegany School of Natural History.

* **V. serpyllifolia** L. subsp. **humifusa** (Dickson) Piper (Piper, 1906) (*V. tenella*). Lawns and old fields; scarce. Pasture, Mount Moriah Swamp, *S & E* 26292; Tenmile Creek, *S & E* 24934. Also collected in moist pasture two to two and one-half miles south of Ischua (to the northeast), *S & E* 24912. Rare in the State. All these specimens are larger than ordinary subsp. *serpyllifolia* with more deeply colored corollas and spreading pubescence. However, in every case, they were growing with ordinary plants of that taxon and others which were typical of it except for being more robust than usual. Variations in intensity of coloration of corolla and disposition of pubescence (stems not spreading-pubescent, stems spreading-pubescent only in inflorescence, stems spreading-pubescent both in inflorescence and below) were noted. If isolation is ever effective, it does not appear so here. Boivin (1952) typifies *V. serpyllifolia* on the element referable to var. *borealis* Laest., which is synonymous with this subspecies. He refers to Hegi (1918). Hegi, however, has three varieties. Pubescence is not emphasized as distinguishing any of them. The description of the color of the corolla of var. *typica* Beck is not correct for this subspecies and Hegi also recognized var. *tenella* (All.) Beck, the basionym of which Boivin refers to the synonymy of this taxon, his var. *serpyllifolia*.

* **Plantago aristata** Mx. Railroad yards; occasional. Allegany, *S & F* 23641. Scattered and locally abundant across the State, except for the mountains and the valleys north of the Adirondacks.

* **Diodia teres** Walt. Railroad yards; occasional. Allegany, *S & F* 24293. Frequent on Long Island and Staten Island; six scattered stations above New York City. Not listed by Zenkert; the nearest county in northeastern Ohio.

Dipsacus sylvestris Huds. Old fields; local. Observed at Killbuck and Oldtown. Reported from Onoville. Common in the State.

* **Anthemis arvensis** L. Waste places and gardens; rare, according to collections, but probably overlooked. Allegany, *anon.* (St. B 2763).

A. cotula L. Waste places; probably frequent. St. Bonaventure, *E* St. B 2764; Allegany, *S & F* 23649; southern Ninemile Hollow, *E* (St. B 3223). Previously reported only from Quaker Bridge.

Artemisia biennis Willd. Railroad yards; occasional. Allegany, *S & F* 23653. Cited as escaped near Elko. Infrequent in the State.

* **A. vulgaris** L. About railroads; local. Allegany, *S & F* 23651, 23652; south of Peth, *S et al.* 27800; Elko, *S et al.* 22760. Becoming frequent in the lowlands of the State.

* **Centaurea jacea** L. subsp. **jacea** (Clausen, 1949). Old fields; rare. Camp Carlton, Allegany State Park, *Hicks* (St. B 2795). Previously reported as *C. nigra*. Locally frequent in the State.

* **C. jacea** L. subsp. **eunigra** Gugler (*C. nigra*—Clausen, 1949). Old fields; rare. YMCA Camp Fancher, Allegany State Park, *Gordon* (St. B 2796). Also reported from the vicinity of Olean.

* **C. maculosa** Lam. Railroad yards; occasional. Allegany, *S & F* 23654. Rapidly spreading in many parts of the State.

* **Coreopsis tinctoria** Nutt. Railroad yards; occasional. Allegany, *S & F* 23648. This species is apparently an adventive, rather than an escape from cultivation.

* **Crepis capillaris** (L.) Wallr. Fields and lawns; scarce. St. Bonaventure, *E* (St. B 3215, 3216); Red House Lake, *S et al.* 23714; observed west of Steamburg. Becoming frequent in central and western New York State and about New York City; rare elsewhere.

Galinsoga ciliata (Raf.) Blake. Waste places; occasional. St. Bonaventure, *E* (St. B 3218); observed in railroad yards, Allegany. Reported from Salamanca. Increasing in the State.

* **Helianthus petiolaris** Nutt. subsp. **petiolaris** (Heiser, 1958). Railroad yards; occasional. Allegany, *S & F* 23647. Appearing in railroad yards in several cities of the State.

* **Hypochaeris radicata** L. Railroad yards; occasional. Allegany, *S & F* 23655. Infrequent in the State.

Leontodon autumnalis L. (*Apargia autumnalis*). Oil fields and waste places; spreading. East Randolph, *S et al.* 24450; observed on south side of Conewango. Reported from St. Bonaventure and the environs of Limestone. Locally frequent in the State.

Matricaria matricarioides (Less.) Porter (*M. suaveolens*). Spreading rapidly in waste places and along roads as elsewhere in the State. Vicinity of Limestone, *S & F* 23145; Allegany, *S & F* 24298; observed at Red House, north of Quaker Bridge and south of Conewango. Reported, hitherto, only from "Allegany State Park."

Sonchus arvensis L. var. **arvensis**. Waste places; occasional. Steamburg, *S et al.* 23729. Previously reported only from Big Basin. The species is considered as locally abundant in the State and the typical variant as the more common of the two (Muenscher, 1935).

* **S. arvensis** L. var. **glabrescens** Guenth., Wimm. & Grab. (incl. *S. uliginosus*). Waste places; occasional. Railroad yards, Allegany, *S & F* 23656; observed at Salamanca. This taxon is reported (Shumovich & Montgomery, 1955) as tetraploid and var. *arvensis* as hexaploid. Their study, however, showed that the difference in chromosome-number was not an absolute barrier.

* **Tragopogon dubius** Scop. (*T. major*). Waste places; rare. Red House, *Alexander & House* 13128, reidentified by House. This is apparently the basis of the single cited station for *T. pratensis*. Spreading in the State.

* **T. pratensis** L. Waste places; infrequent. Observed west of Allegany and at Carrollton. Distinctive by its slender peduncles and short bracts. Locally abundant in the State.

III. NATIVE PLANTS

Despite the evidence of awareness of introduced species reported in the first two sections of this paper, the writer is particularly interested in the native plants and their geography. He is here reporting such as are new, rare or otherwise interesting. There are obviously some groups still to be collected and studied in detail, such as *Crataegus*, *Rubus* and *Viola*.

The most notable additions were made in the upland oak woods and the alluvial bottomlands. The former produced a number of species of more austral range; the latter yielded some taxa of more austral and more midwestern range. The valley of Conewango Creek, marginal to the area on the northwest, harbored a few items of calciphile tendencies. One of the striking features noted was the pairing of related taxa in distinctive habitats: *Arisaema triphyllum* subsp. *stewardsonii* in bottomlands and *A. triphyllum* subsp. *triphyllum* in uplands; *Uvularia perfoliata* in oak woods as opposed to *U. grandiflora* in mixed hardwoods; *Asarum canadense* var. *reflexum* in bottomlands with *A. canadense* var. *canadense* in uplands.

The other pleasant surprise was in the discovery of several new Alleghenian elements, the presence of which was foreshadowed by the frequency of *Clintonia umbellulata*. Among these should be noted: *Lilium canadense* subsp. *editorum*, *Baptisia tinctoria* var. *projecta* and *Chelone glabra* subsp. *elatiior*. Detailed search should reveal more stations for these and probably still other Alleghenian types.

***Taxus baccata* L. subsp. *canadensis* (Marsh.) Pilger** (*T. canadensis* —Clausen, 1949). Swamps and moist wooded slopes; some additional stations. Vicinity of Peth, *E & Piorkowski*, Aug. 25, 1955 (St. B); *E et al.* (St. B 342); observed at Mount Moriah Swamp.

***Abies balsamea* (L.) Mill.** Wet woods; another station. Mount Moriah Swamp, *E et al.* (St. B 348). Previously reported only from Balsam Swamp, Red House. Local in central and western New York.

***Typha latifolia* L.** Ditches and swales; local. Krampf's Pond, Ten-mile Road, *E* (St. B 3034); observed north of Riverside Junction, opposite Red House, around Steamburg, east of Blacksnake Mountain. Apparently, the frequency is governed by a lack of suitable habitats. Considered common by McVaugh (1938) but rare by House and Alexander.

***Sparganium eurycarpum* Engelm.** Marshes and sloughs; a second station. Observed at Horseshoe. Reported only from Randolph. Common in lakes of the watershed (McVaugh, 1938).

* ***Potamogeton perfoliatus* L. subsp. *bupleuroides* (Fern.) Clausen** (Clausen, 1949). Rivershores; rare. Horseshoe, *S et al.* 27782; stranded on shore of island below Red House, *S et al.* 23612. Not reported from the Allegheny (McVaugh, 1938). A specimen from Olean, *E* (St. B 403) was reported as *P. richardsonii* (Benn.) Rydb. The vegetative characteristics of this specimen are considered by Ogden to be transitional to those of *P. perfoliatus* as in other eastern material studied by him (Ogden, 1943).

* **P. spirillus** Tuck. Ponds; rare. Krampf's Pond, Tenmile Road, E (St. B 3035, 3036). Locally abundant in the watershed (McVaugh, 1938).

Alisma plantago-aquatica L. var. **parviflorum** (Pursh) Farw. (*A. subcordatum*). All identifiable specimens of this species seem to be of this taxon, characterized, *inter aliis*, by small flowers, small achenes and narrowly margined sepals. There is considerable disagreement on the status and distribution of the Water Plantains related to typical European *A. plantago-aquatica* (cf. Fernald, 1946; Hendricks, 1957; Samuelson, 1932; Wiegand & Eames, 1926).

Elodea nuttallii (Planch.) St. John (*E. occidentalis*; *Anacharis nuttallii*). Ponds and margins of streams; rare. Horseshoe, S *et al.* 26415. Reported from East Randolph. Not listed by McVaugh (1938).

Agropyron trachycaulum (Link) Malte. Oak woods; occasional. Southwest of Quaker Bridge, S & F 24498. The only other specimen seen from the area is that from the slope opposite Red House. Both specimens are referable to var. *glaucum* (Pease & Moore) Malte. Rare in western New York.

* **Agrostis stolonifera** L. var. **stolonifera** (*A. alba auct.*, p. p.; *A. stolonifera auct.*, p. p.—Philipson, 1937). Along streams; frequent. Across river from St. Bonaventure, S *et al.* (St. B 3154); Limestone, S & F 23170; Red House Creek Valley, *Alexander & House* 12637; observed on west side of Allegany, west of Vandalia, Horseshoe, on north side of Salamanca, at the East Randolph Fish Hatchery and on the islands below Red House. This species is characterized by lack of scaly rhizomes, by rooting at the nodes of the decumbent basal parts of the flowering stems and by the contracting of the panicle-branches and branchlets after anthesis. On streamsides or gravelbars, it frequently develops long prostrate leafy shoots which root near the base. Frequent in the State.

* **Andropogon gerardii** Vitman (*A. furcatus*). Riverbottom fields; scarce. Observed at Oldtown and Horseshoe. Reported from Olean Rock City to the east; considered frequent in western New York.

* **Andropogon virginicus** L. var. **virginicus**. Old fields; rare. Slope bordering Red Pond, S. *et al.* 23777; S & Schumacher 24392. Common on the coast of New York but rare upstate. Known from the eastern Great Lakes Plains northeast to Erie County, Pa.; new to the High Upland of Jennings' region.

* **Brachyelytrum erectum** (Schreb.) PB. var. **erectum**. Oak woods; rare. Tenmile Hollow, E (St. B 3188). As yet, there are no other morphological characters correlated with that of pubescent lemmas. However, it should be noted that this variety is common in New York State only in the vicinity of New York City. All other stations are scattered and mostly at lower elevations along the larger streams or lakes. The var. *septentrionale* Babel, with glabrous to scabrous lemmas, is the common representative in New York State, as it is here, and is equally as common as var. *erectum* around New York City.

Bromus ciliatus L. Oak woods; possibly rare and certainly not common as indicated. The only two specimens seen are: west of Red House, S *et al.* 24433; Elko Mountain, *Alexander*, August 31, 1926.

* **Echinochloa muricata** (PB.) Fern var. **muricata** (*E. pungens*—Fairbrothers 1956). Rivershores and ditches; frequent. Horseshoe, *S et al.* 27797; roadside ditch west of Steamburg, *S & Schumacher* 24368; Oldtown, *S et al.* 24488; Elko, *S et al.* 24473. Known from Warren County, Pa.

* **E. muricata** (PB.) Fern. var. **microstachya** Wiegand (*E. pungens* var. *microstachya*; *E. microstachya*—cf. Wiegand & Eames, 1926). Gravelbars along the river; occasional. Horseshoe, *S et al.* 27798; Oldtown, *S et al.* 24489. Reported from Chautauqua County. None of the older specimens of cockspur grass, which were seen by the author, belongs to either race of this native species. Records in the herbarium of the New York State Museum indicate that both races are frequent in western New York as in central.

Elymus villosus Muhl. Along the larger streams; probably frequent. Islands below Red House, *S et al.* 23624; mouth of State Line Run, *S & F* 23236. Observed at Limestone, Horseshoe, Killbuck and Oldtown. Reported from Riverside Junction and the vicinity of Peth. This never seems to form large colonies in this State but occurs as occasional clumps among other grasses.

Elymus wiegandii Fern. (incl. in *E. canadensis* by Gleason, 1952, and Chase, 1950). Riverbottom woods; abundant there. Islands below Red House, *S et al.* 23622; Quaker Bridge, *S & F* 23488. Observed at Riverside Junction, Horseshoe, Oldtown and the mouth of State Line Run. Also reported, as *E. canadensis*, from the vicinity of Elko and Great Valley Creek, one mile south of Peth. On a canoe-trip from Red House to Quaker Bridge, one of the most conspicuous sights all along the route on both islands and shores was the large pale pendent plumes of this species. Despite its showiness, the species has been overlooked in many parts of the State.

* **Eragrostis frankii** C. A. Mey. Gravelly soil; rare and possibly introduced. Weedpatch, East Randolph Fish Hatchery, *S et al.* 24461; roadside, Oldtown, *S et al.* 24483; gravelbars, Oldtown, *S et al.* 24484. Local in the State. Many of the collections of this uncommon species seem to be from disturbed habitats.

E. hypnoides (Lam.) BSP. Muddy shores of the Allegheny and similar habitats; probably frequent in such places. Gravelpit, Russell, *E*, Sept. 23, 1956 (St. B); Horseshoe, *S et al.* 27795; west of Red House, *S et al.* 24434; Oldtown, *S et al.* 24485; near Onoville, *Gordon* (St. B 436); observed on islands below Red House. Previously reported only from the mouth of Red House Creek. This species is local in the State but is usually overlooked.

Glyceria canadensis (Mx.) Trin. Swamps; locally abundant and not restricted to the bogs at the edge of the glacial drift as stated earlier. Bottoms of the Tunungwant Creek near Limestone, *S & F* 23173, 23539; swale at Carrollton, *S & F* 23450.

* **G. septentrionalis** Hitchc. Swales and swamps; frequent in the lowlands. Vicinity of Limestone, *S & F* 23172, 23537; Carrollton, *S & F* 23449; two and one-half miles north of Riverside Junction, *S & F* 23189; observed north of Randolph and at the bogs north of Steamburg. Marginal collections are from west of Leon, *S et al.* 22613, and Cherry Creek, Chautauqua County, *S et al.* 22636, and it has been

observed at Portville on the Allegheny River to the east. Reported from Celeron to the west. Although it is a prominent element of the flora, being particularly showy in the Conewango Creek Valley and abundant in low ground about Randolph, this handsome grass with its large spikelets has been previously overlooked, possibly because of its early shattering of spikelets. Rare in eastern and southeastern New York; not uncommon from Utica and Greene (Chenango County) westward.

* *Muhlenbergia frondosa* (Poir.) Fern. (*M. mexicana* auct.). On gravelbars; also weedy in curbing; frequent. Horseshoe, *S et al.* 27792; Randolph, *S et al.* 24438; islands below Red House, *S et al.* 23626; observed in railroad yards at Allegany and along a small stream on the west side of Allegany. Considered infrequent in western New York.

* *M. mexicana* (L.) Trin. (*M. foliosa* auct.). Ditches; a single collection. Near Randolph, *S et al.* 24437. Probably overlooked. Considered frequent in western New York; sparing on the High Plateau.

* *M. schreberi* Gmel. Weedy as elsewhere in the State; probably frequent. Railroad yards, Allegany, *S & F* 24318; curbing, Randolph, *S & F* 24439. Infrequent in Zenkert's area; not common on the High Plateau.

* *M. sylvatica* Torr. Oak woods; rare. Seepage-run on steep slope, Killbuck, *S et al.* 27731. Locally frequent in the largest valleys of the State but rare elsewhere; infrequent in western New York.

* *M. tenuiflora* (Willd.) BSP. Oak woods; rare as elsewhere in western New York. With the last, *S et al.* 27732. The ranges of this and *M. sylvatica* are nearly identical in this State.

Panicum capillare L. Disturbed soil in the larger valleys; common. Railroad yards, Allegany, *S & F* 23695; one-quarter mile east of Vandalia, *E* (St. B 3174); Riverside Junction, *S et al.* 23138; observed at mouth of Tenmile Creek, Killbuck, Steamburg and Oldtown. Weedy as always in the State. House and Alexander reported it only from the valley of the Tunungwant Creek and suggested that it was not native. This is one of the annual species of disturbed situations which become much more abundant on soil cultivation. Whether it is an old species of the area, once restricted to small exposed areas after temporary disturbances and now more widespread, or whether it came as a weed in Indian cultivation is a problem that applies to the whole State.

* *P. gattingeri* Nash (*P. capillare* var. *campestre*). Gravelbars and roadsides; frequent. Mouth of Tenmile Creek, *S & Ketchledge* 25839; west of Steamburg, *S & Schumacher* 24367; Oldtown, *S et al.* 24487. Rare in western New York. Another witchgrass which may be introduced or may be native, preferring disturbed soils.

P. latifolium L. Sparse in dryish oak woods; a few more stations. Riverside Junction, *S et al.* 23139, 23140; north of Quaker Bridge, *S et al.* 22597; observed east of Vandalia, at Killbuck and southwest of Quaker Bridge. The two earlier stations were on the west edge of the park.

P. linearifolium Scribn. Old fields; a new station. Carrollton, *S et al.* 23456. This is referable to var. *wernerii* (Scribn.) Fern., a distinctive variant, but one without apparent isolation. Earlier localities cited for the species (including both varieties) were all from below Steamburg

and Red House.

* ***P. philadelphicum*** Bernh. Gravelbars; rare (?) Horseshoe, *S et al.* 27796. The specimens belong to var. *tuckermanii* (Fern.) Steyermark & Schmoll (*P. tuckermanii*—Steyermark & Schmoll, 1939). This variety seems to favor borders of alluvial swamps and gravelbars. The few specimens of var. *philadelphicum* observed by the author seem to be from more sterile and drier upland soils; an ecotype difference may be involved. The variety is apparently a new find for that part of New York State west of Cayuga Lake. The species is otherwise known in that same part of the State by var. *philadelphicum* from Windom, Erie County, *F. W. Johnson*, October 19, 1924.

* ***Paspalum ciliatifolium*** Mx. Old fields; rare as elsewhere upstate. Red Pond, *S & Schumacher* 24391. The material belongs to var. *muhlenbergii* (Nash) Fern. The nearest stations in New York are in northern Livingston County and eastern Monroe County; Jennings does not report it from northwestern Pennsylvania.

Phalaris arundinacea L. Bottomlands; common in the valley of the Allegheny River and the flats around Randolph. Hemlock Swamp near Quaker Bridge, *Saunders* (St. B 488, 489); observed at Riverside Junction, Carrollton, Horseshoe, Salamanca, Steamburg, Randolph, north of Randolph and at mouth of State Line Run. The only previous report seems to be "Alleghany State Park" with no further designation.

Poa alsodes Gray. Rich woodlands, including those on the bottoms; common. East of Russell, *S & E* 26265; Bradford (Riverside) Junction, *Wiegand* 15226 (Specimen at Cornell University); Horseshoe, *S & E* 26450; observed at South Vandalia Oxbow, Tenmile Hollow, Elko and Frecks. This is one of the earlier grasses to mature and shatters quickly, which may account for its being overlooked previously. The only citation was, again, "Alleghany State Park."

* ***P. languida*** Hitchc. Dry oak woods; a single station. Riverside Junction, *S et al.* 23130. Frequent in western New York; missing from northwestern Pennsylvania. This species is very close to *P. saltuensis* and varies in practically all the differentiating characters (Clausen, 1939). This is the only specimen found which is good *P. languida*. All others are *P. saltuensis* or transitional.

P. saltuensis Fern. & Wieg. Dry oak woods; apparently frequent. St. Bonaventure, *S & E* 24945; Killbuck, *S & E* 26503; Elko, *S et al.* 22787; observed at Riverside Junction. Rarer in more mesic habitats: Horseshoe, *S & E* 26451; observed along lower Tenmile Creek. Reported as occasional, "especially along Quaker Run." Rather rare in western New York and in the area just south.

Spartina pectinata Link. Riverbanks; not as rare as previously indicated. Horseshoe, *S & E* 26455; *S et al.* 27799; observed at Quaker Bridge. Reported only from a locality just one mile north of this station. A large clump of grass, west of the village of Alleghany, in a weedy area, was dense enough to simulate one of the big tussock grasses; it never flowered, but a specimen (*S & F* 23630) had the ligules, collars and blades of this species. Rare in western New York.

* **Sphenopholis intermedia** (Rydb.) Rydb. Oak woods; rare or overlooked. Riverside Junction, *S et al.* 23126; observed at Carrollton. This species, like the next, never seems to occur in abundance in any locality in this State. Frequently, there will be but a plant or two and they shatter quickly. Rare in western New York.

* **S. nitida** (Biehler) Scribn. Oak woods; rare or overlooked. Riverside Junction, *S et al.* 23127, 25029; observed east of Vandalia. Rare in western New York.

* **Carex albursina** Sheldon (*C. laxiflora* var. *latifolia*). Rich woods; occasional. East of Russell, *E et al.*, May 20, 1958 (St. B). Notes on ranges of species of *Carex* relatively frequent at lower elevations across the State are omitted.

C. amphibola Steud. var. **turgida** Fern. (*C. grisea* auct.). Low woods; four more stations, all in the valleys east and southeast of Salamanca. East of Vandalia, *E*, June 4, 1956 (St. B); South Vandalia Oxbow, *S & E* 26329; Carrollton, *S & F* 23428; Horseshoe, *S & E* 26430. Reported only from Limestone.

C. annectens (Bickn.) Bickn. Fields; occasional, but possibly more frequent than apparent, due to confusion with *C. vulpinoidea* Mx. Harrisburg, *S et al.*, July 26, 1956 (St. B); St. Bonaventure, *E et al.* (St. B 562); Riverside Junction, *S & F* 23123; Tenmile Hollow, *E*, June 27, 1956 (St. B); Bear Bog, south of Halls, *S et al.* 22809. These specimens are all var. *annectens*. A specimen from a dry old field, two miles east of Red House, *S* 23181, is clearly var. *xanthocarpa* (Kük.) Wieg. (*C. brachyglossa*—cf. synonymy, Mackenzie, 1931-35). A specimen from Carrollton, *S & F* 23437, and those previously reported as *C. brachyglossa* seem transitional.

* **C. arcia** Boott. Swales; rare. Carrollton, *S & F* 23438. This species is one of the rarest in the State. There are only two other stations represented in the herbarium of the New York State Museum: vicinity of Axton, Franklin County, *Rowlee et al.*, July 11, 1899, and Truxton, Cortland County, *Wiegand*, June 1896. Jennings does not record this species and neither Mackenzie (1931-35) nor Hermann (1954) cites it from south of New York.

* **C. artitecta** Mack. (*C. nigromarginata* var. *muhlenbergii*). Dryish oak woods; rare. Riverside Junction, *S & E* 25017; north side of Salamanca, *S & E* 26521.

* **C. brevior** (Dewey) Mack. Open oak woods; rare. North side of Salamanca, *S & E* 26522. Rare and local throughout the State outside of the mountains.

C. bromoides Schk. Swales and wooded swamps; frequent. Tenmile Hollow, June 27, 1956 (St. B); observed at St. Bonaventure, South Vandalia, Mount Moriah, Riverside Junction, Carrollton and Horseshoe.

C. brunnescens (Pers.) Poir. Moist woods and boggy thickets; more common than indicated by House and Gordon. St. Bonaventure, *S* 24942; Carrollton, *Peck*, June; Salamanca Rock City, *Alexander & House* 13047; Quaker Bridge, *Alexander & House* 13017; Bear Bog, *S et al.* 22810; observed at South Vandalia Oxbow. All records are referable to var. *sphaerostachya* (Tuck.) Kük.

C. canescens L. Bogs and swamps in the River Valley; occasional. St. Bonaventure, *S* 24943; Mount Moriah Swamp, *E*, June 4, 1956

(St. B) ; South Vandalia Oxbow, *S & E* 26331. Reported from the bogs north of Steamburg and later as being common in Bear Bog, but the present investigator could find only the abundant *C. brunnescens* (of this series of species) in the latter station.

* *C. caroliniana* Schw. New to the State (Mackenzie, 1931-35; Hermann, 1954). Dry old field east of Red House, *S & F* 23183. This species with the stiff habit and fat perigynia of *C. bushii* Mack., for which the specimen was taken in the field, has smaller perigynia, less cuspidate pistillate scales and glabrous leaves. Taylor (House, 1924) cited a doubtful collection from Aqueduct (Long Island), but Mackenzie apparently did not accept it as he ranges this species north to New Jersey and Pennsylvania. Jennings reports this from Clarion County, Pa., on the south side of the High Plateau section; this would be the nearest station.

Carex cephaloidea Dewey (*C. sparganioides* var. *cephaloidea*). Low woods; another station for this sedge, which is apparently infrequent in the area. Horseshoe, *S & E* 26443.

C. debilis Mx. var. *rudgei* Bailey. Acid woods; frequent in the Conglomerate sections and somewhat so elsewhere. Additional stations are: Harrisburg, *S et al.*, July 26, 1956, (St. B) ; Coon Run, *anon.* (St. B 616, *p. p.*) ; observed at St. Bonaventure, Salamanca Rock City and north of Steamburg.

C. emoryi Dewey (*C. stricta* var. *elongata*). Sloughs; a second station. Muddy borders of Oxbow, Horseshoe, *S & E* 26439. The shores of the Allegheny River are the only stations in New York State, the first collection being from near Quaker Bridge. Jennings reports it from northeastern Ohio and from three counties in western Pennsylvania, none of them on his High Plateau.

C. gracilescens Steud. (*C. laxiflora*, *auct.*; *C. laxiflora* var. *gracillima*). Moist rich woods and seepage banks at edge of same; frequent near the Allegheny River. Three-quarters of a mile east of Vandalia, *E*, June 4, 1956 (St. B) ; South Vandalia Oxbow, *S & E* 26328; Riverside Junction, *S & E* 25022; Horseshoe, *S & E* 26434; north side of Salamanca, *S & E* 26519; opposite Red House, *S & E* 24982; north of Cold Spring, *S & E* 24957. Previously recorded only from Carrollton. This species is the most slender of the group closely allied to true *C. laxiflora*. It is further characterized by distinctly purple outer basal sheaths and more divaricate-arcuate paler perigynia. The plants have a distinctive appearance in the field.

C. granularis Muhl. Wet fields; apparently rare. Observed as disintegrating specimens at Killbuck, September 9, 1958, swaly field, one-half mile south of Conewango, *S et al.* 22653. Both stations are for var. *haleana* (Olney) Porter (*C. haleana*) previously reported only from a station near the Allegany School of Natural History. Both this and var. *granularis* are not infrequent in New York State outside the mountains, but there seems to be no general difference in occurrence.

* *C. grvida* Bailey var. *grvida*. New to the State. Alluvial flats, north of Quaker Bridge, *Alexander & House* 12203. This specimen was inadvertently misfiled with out-of-state specimens at the time of preparing the flora and the supplement. Dr. House discovered it shortly before he died and reaffirmed that all the specimens of *Carex* of that

effort had been identified by Mackenzie. It agrees fairly well with specimens from Illinois. House earlier had cited a possible mislabeled specimen from Sullivan Hill, Chemung County. This specimen, also identified by Mackenzie, seems to this writer to be referable to the related *C. aggregata* (*C. sparganioides* var. *aggregata*). The first record east of Ohio and lower Ontario.

C. grayii Carey (*C. asa-grayi*). Low woods of the river valley; not uncommon. Opposite St. Bonaventure, *S et al.*, July 26, 1956 (St. B); Carrollton, *S & F* 23436; Horseshoe, *S & E* 26442; river islands below Red House, *S et al.* 23619; observed at Quaker Bridge and mouth of State Line Run. Reported from Riverside Junction and the Balsam Swamp, Red House. The latter specimen could not be located and the habitat would be most unusual. Local in the larger valleys of the State.

C. hirtifolia Mack. Alluvial woods; possibly frequent, but fruiting and shattering early. South Vandalia Oxbow, *S & E* 26327; Riverside Junction, *S & E* 25016; Horseshoe, *S & E* 26437. House and Gordon give the habitat as "Dry fields, banks and open woodlands." The writer has never seen it in really dry sites.

* **C. intumescens** Rudge var. **fernaldii** Bailey (*C. intumescens*, p. p., of Gleason). Swampy woods; frequent. Carrollton, *S & F* 28049; near Murray Brook, *Gordon* (St. B 667); upper Red House Valley, *Gordon*, July 7, 1936; observed at Frecks. The material from Carrollton and that from the upper Red House Valley has the obovoid achenes with inflated perigynia and represents f. *ventriosa* Fern. A specimen from Quaker Run, *Alexander*, August 19, 1927, seems to be intermediate in achene-shape and perigynium-inflation between var. *intumescens* and var. *fernaldii* f. *fernaldii*. The var. *fernaldii* is probably commoner at higher elevations and in the colder swamps than is var. *intumescens*.

* **C. laevivaginata** (Kük.) Mack. Seepage areas in dry oak woods and swales; occasional. Riverside Junction, *S & E* 25028; meadow, south side of Conewango, *S et al.* 22655; Balsam Swamp, Red House, *Alexander* (St. B 571); Big Woods (Stoddard Hollow), *Alexander*, August 1926 (St. B); observed in alluvial woods at Carrollton. Probably overlooked for *Carex stipata* Muhl., under which name both the *Alexander* specimens rested. It is interesting to note that all the habitats apparently show moisture but seem to have little else in common.

C. laxiflora Lam. (*C. heterosperma*). Mixed or oak woodlands; frequent. Coon Rocks, northeast of Limestone, *E & Donahue*, July 28, 1956 (St. B); Tenmile Hollow, *E*, June 27, 1956 (St. B); Riverside Junction, *S et al.* 23122; *S & E* 25019; Killbuck, *S & E* 26488; observed at Horseshoe in alluvial woods.

C. leptalea Wahl. subsp. **leptalea** (Stone, 1911). Wooded swamps and swales; two more stations. Mount Moriah Swamp, *S & E* 26298; south side of Conewango, *S et al.* 22652. The latter station is remarkable for being in full sun, an unusual habitat for this part of the State.

* **C. muricata** L. var. **laricina** (Mack.) Gleason. (*C. cephalantha*, Fernald, 1950, p. p.; *C. laricina*). New to the State. Balsam Swamp, Red House Valley, *Alexander & House* 12620. This is the basis of the report of *C. angustior*. The relationship of these variants of *C. muricata* is very difficult to assess. This collection with perigynia smaller than in subsp. *cephalantha* (Bailey) Clausen (*C. cephalantha*—Clausen, 1949) and

more ovate with more strongly serrulate beaks than in *C. angustior* Mack. (*C. muricata* var. *angustata*) seems best referred here. The perigynia are lightly many nerved ventrally at base and the pistillate scales are blunter than in good subsp. *cephalantha*. The beaks, however, are about one-half the length of the bodies, which is long for var. *laricina*. This taxon, as a species, is cited (Mackenzie—1931-35) from the area about the upper Great Lakes, from Presque Isle, westward. Fernald (1950) reduces it outright to *C. cephalantha*.

C. pedunculata Muhl. Rich woods; frequent to common. East of Russell, *E et al.*, May 20, 1958 (St. B); observed at St. Bonaventure, South Vandalia Oxbow, Mount Moriah Swamp, the bogs north of Steamburg and Frecks. Reported from three other stations by Eaton. Overlooked because of early fruiting.

C. pensylvanica Lam. var. *pensylvanica*. Dry slopes and banks; additional stations. St. Bonaventure and vicinity; *E & Donahue* (St. B 686); *E et al.* (St. B 592, 593, 594); *S* 24995; Tributary 49, Allegheny River, *E* (St. B 591, p. p.); Killbuck, *S & E* 26493; observed at South Vandalia Oxbow, Horseshoe and Riverside Junction. Reported only from Red House Valley and downriver.

C. plantaginea Lam. Rich woods; several more stations. East of Russell, *E et al.*, May 20, 1958 (St. B); *S & E* 26263; north-facing slope, Town of Allegany, *E et al.*, April 22, 1958 (St. B); Tributary 49, Allegheny River, *E et al.* (St. B 629); 1 mile south of Peth, *E et al.* (St. B 630); observed southwest of Quaker Bridge and at Frecks. Listed as infrequent with only a single cited station at Quaker Run.

C. rosea Schk. Alluvial woods; two additional stations. Riverside Junction, *S & E* 25027; Horseshoe, *S & E* 26445. Considered uncommon and reported only from Limestone.

* **C. rostrata** Stokes. Alluvial soils in open marshes; scarce. Tunungwant Swamps, *S & F* 23163; *S et al.* 23532; Carrollton, *S & E* 26335.

* **C. seorsa** Howe. Wet woods; a single station. Mount Moriah Swamp, *E*, June 4, 1956 (St. B). Frequent only about Oneida Lake and locally in the region of New York City and Long Island; otherwise scattered (five stations) in upper New York.

Carex sparganioides Muhl. Dry oak woods; two more stations. Killbuck, *S & E* 26497; observed at Carrollton.

C. swanii (Fern.) Mack. Old fields and pastures; probably frequent. Eaton's Pond, Tenmile Valley, *E*, June 27, 1956 (St. B); south side of Conewango, *S et al.* 22651; observed one and one-half miles west of Allegany, in the vicinity of Red House Lake and near the Steamburg Bogs.

C. trichocarpa Muhl. Bottom lands, often in woods; frequent; new stations. Horseshoe, *S & E* 26440; Oldtown, *S et al.* 23508, 23796; south of State Line Run, *S & F* 23232. At Oldtown, it almost completely filled a large depression in a cultivated field of corn. Cited previously as occasional, it appears as a dominant species along many parts of the Allegheny River. Many places, it seems not to fruit well but is easily recognized by the purple-brown "necktie" of the upper sheaths.

C. trisperma Dewey. Thicketed bogs and wet woods; apparently rare: Bear Bog, *S et al.* 22811; Halls, *anon.* (St. B 574). These appear to be

var. *trisperma*, but var. *billingsii*, Knight, to which the previous records from Balsam Swamp and the Steamburg Bogs belong, seems to be primarily an attenuated form of sphagnum bogs.

* ***C. typhina* Mx.** Wet meadows; rare. Riverflats near Quaker Bridge, *Alexander & House* 12224. This specimen was apparently overlooked in the earlier reports. There are 17 stations scattered around the lower elevations of the State; 7 of these are on Long Island. Local in western Pennsylvania.

* ***C. umbellata* Schk.** (*C. abdita* Bickn.). Probably overlooked because of early maturing, small size and the characteristic of the fruit's being mostly hidden in the leafy sods. Dry fields and open thickets; scarce (?) Allegany, *S* 24996, 24997; Killbuck, *S & E* 26495, 26496. Reported from Camel Back, Olean. These collections are somewhat variable in all characters used to segregate *C. rugosperma* Mack. (*C. umbellata auct.*) The complex should be restudied.

* ***C. vesicaria* L.** Bottom lands; occasional to locally abundant. A prominent species in the swamps of the Tunungwant Creek near Limestone, *S & E* 23162; swales at Carrollton, *S & F* 23430, 23431; observed at Horseshoe. A specimen from the river islands below Red House, *S et al.* 23617, had sterile inflated perigynia and may be of hybrid origin.

* ***Cyperus rivularis* Kunth.** Wet meadows; rare. South side of Conewango, *S & Ketchledge* 25828. This should be found in similar habitats and on gravelbars along the Allegheny. Frequent, at low elevations, across the State.

***Dulichium arundinaceum* (L.) Britton.** River shores, sloughs and bogs; probably frequent. Horseshoe, *S & E* 26429; observed on river islands below Red House. Previously reported from the Tunungwant Valley and the Steamburg Bogs, but not definitely reported from the borders of the Allegheny River, proper, although considered common by McVaugh (1938).

* ***Eleocharis calva* Torr.** Rivershores, bogs and wet meadows; probably frequent. South side of Conewango, *S et al.* 22649; observed about the Steamburg Bogs and on the margins of islands below Red House. Local according to McVaugh (1938).

* ***E. tenuis* (Willd.) Schultes** var. ***borealis* (Svenson) Gleason** (*E. elliptica*). Wet meadows; rare. South side of Conewango, *S et al.* 22650. Not listed by McVaugh (1938).

* ***Eriophorum viridi-carinatum* (Engelm.) Fern.** Swaly meadow; rare. South side of Conewango, *S et al.* 22647. The only previous record, Waterman Swamp, is outside the area studied and much more isolated from the Allegheny River than this. Its presence in the Conewango Valley suggests that it might be found to the south in the flats around Randolph and Steamburg. Locally frequent, as the next, across the State.

* ***Scirpus lineatus* Mx.** Open swaly fields; infrequent. South side of Conewango, *S et al.* 22648; observed just north of Randolph.

* ***S. rubrotinctus* Fern.** Swales; frequent. Limestone Creek, south edge of Limestone, *S & F* 23160; north side of Salamanca, *S & E* 26518; Quaker Run near mouth of Cain Hollow, *S & F* 23193. A specimen from the watergarden at the Allegany School of Natural History, Gordon, August 5, 1940, was considered by the collector as "probably

introduced," but it could have come in naturally. This taxon, which is proving not uncommon in upstate New York has uniformly small achenes, *ca.* 1.0 mm. In every other character cited by Fernald (1900) and by Beetle (1947) as separating this from *S. microcarpus* Presl, there is variation. This is probably a subspecies of *S. microcarpus*.

Arisaema triphyllum (L.) Schott subsp. **stewardsonii** (Britton) Huttleston (*A. stewardsonii*—Huttleston, 1949). Alluvial woods and wooded swamps; frequent. Mount Moriah Swamp, *S & E* 26296; South Vandalia Oxbow, *S & E* 26326; Horseshoe, *S & E* 26426; Elko, *S et al.* 22623; observed at Riverside Junction, on the islands below Red House, at Oldtown and at the mouth of State Line Run. Previously reported only from the Steamburg Bogs. Subsp. *triphyllum* (*A. atrorubens*) is rare in alluvial woods, hereabouts, but is common in the drier woods above the bottoms. Probably more frequent than previously reported for upstate New York.

* **Juncus acuminatus** Mx. Ditches, oxbows, about bogs, etc.; frequent. Limestone, *S & F* 23155; Horseshoe, *S et al.* 27784; gravelpit near Red House, *S & F* 23179; Steamburg Bogs, *S et al.* 24389; Stillson's Pond, East Randolph, *Gordon* (St. B 937). Frequent at lower elevations, about the State.

J. breviaudatus (Engelm.) Fern. Swales; rare. Field, one-half mile south of Conewango, observed. Previously reported from a bog near Randolph. Rare in central and western New York.

* **J. marginatus** Rostk. Swales; rare. Field, one-half mile south of Conewango, *S et al.* 22646. Rare in western New York. Not cited as being near area on the south.

* **J. tenuis** Willd. var. **dudleyi** (Wieg.) Hermann (*J. dudleyi*—Hermann, 1944). Swales; rare. Field, one-half mile south of Conewango, *S et al.* 22644. This race apparently favors more alkaline soils than var. *tenuis*, which accounts for its rarity here. Frequent in the State, mostly at lower elevations.

Allium canadense L. var. **canadense** (Ownbey & Aase, 1955). Low fields and woods; common in the Tunungwant Valley and along the Allegheny River above and below the mouth of the Tunungwant. Limestone, *Alexander & House* 12700; St. Bonaventure, *E et al.*, April 15, 1958 (St. B); Horseshoe, *S & E* 26418. Previously cited only from Riverside Junction. Frequent at low elevations in the State.

Clintonia umbellulata (Mx.) Morong. Rich woods; more frequent than the three cited stations would indicate. Sixteen stations are known in the area covered. Known only from Letchworth Park, Livingston and Wyoming Counties, south and west in the State. An Alleghenian species.

Erythronium americanum Ker. Rich woods and low thickets; frequent, as indicated, at least in the main valley. Allegany, *anon.* (St. B 746); St. Bonaventure, *E et al.* (St. B 744); east of Russell, *E et al.*, May 20, 1958 (St. B); Horseshoe, *S & E* 26421; one mile southwest of Peth, *E* (St. B 745); Jack Point, Onoville, *Fenton* 452; observed at Riverside Junction. These substantiate the earlier estimate of frequency without cited stations. Common in the State, except for central Long Island.

Lilium canadense L. subsp. **canadense**. Low grounds; apparently rare. Populations of the common race (in New York State) were never seen in the area by the writer, although a colony was found in wet woods at Cherry Creek, Chautauqua County, in the Conewango Valley. The only old specimen found was from Quaker Bridge, *Alexander & House* 12550, but that had flowers that at least approached those of the next, being dusky red and with weakly recurved tepals. The leaves were too narrow for that taxon, however. A specimen from north of Quaker Bridge, in a mixed population, *S & F* 28052, was depauperate, but apparently this, on purely morphological grounds.

* **L. canadense** L. subsp. **editorum** (Fern.) Wherry (*L. canadense*, p. p. of Gleason, 1952—Wherry, 1947). Seepage areas on banks bordering oak woods and in meadows below such areas; occasional. Just west of Vandalia, *S & F* 20753; *E*, July 27, 1956 (St. B); opposite Red House, *S & F* 23073. This is the north edge of the range and the plants are variable. They are referred here on the basis of the narrow dark garnet-red tepals, which are comparatively weakly flaring, giving the effect of a long tubular base to the flowers. The leaves vary from those typical of this subspecies to those far too narrow and attenuate. The Vandalia colony is the most typical and the most uniform. A collection from north of Quaker Bridge was relatively small-leaved. Two plants (*S & F* 23197) had the leaves about one-quarter as long as broad and blunt. The third (*S & F* 28052) had them one-sixth to one-ninth as long as broad and attenuate; the tepals were broader, much lighter, with more yellow pigmentation and more markedly flaring at tip. This third specimen is cited under the typical subspecies. Jennings lists only subsp. *editorum* for western Pennsylvania.

* **Polygonatum biflorum** (Walt.) Ell. Open oak woods; rare. Riverside Junction, *S & F* 24504; Killbuck, *S & E* 26486. In many parts of the State, particularly near the larger valleys, this species seems less common than the next.

P. commutatum (R. & S.) Dietr. (*P. canaliculatum* auct., incl. *P. giganteum*—R. P. Ownbey, 1944). Alluvial thickets; infrequent. Observed above Quaker Bridge, south of Quaker Bridge and at Oldtown. Reported only from near Cold Spring. The author thinks this should be treated as a subspecies (cytotype) of *P. biflorum*.

* **Uvularia perfoliata** L. Acid woods and thickets and old fields; frequent. 1 mile west of Harrisburg, *E et al.* (St. B 721); Riverside Junction, *S & F* 23117; *S & E* 25031; Killbuck, *S & E* 26485; north of Red House, *Fenton* 308; north of Cold Spring, *S & F* 23791; Cold Spring, *Fenton* 23; observed opposite Red House and southwest of Quaker Bridge. This was originally reported as common in the region but was later considered to be absent, on the basis of available specimens which proved to be *U. grandiflora*. *U. perfoliata* has the wider range in the State.

* **Hypoxis hirsuta** (L.) Coville. Probably open oak woods or fields nearby; rare. Allegany, *anon.* (St. B 826). No data as to habitat is on the label. It is not surprising to find it here in view of its occurrence in the Chemung Valley. Jennings cites it as common, except in his High Plateau.

Goodyera repens (L.) R. Br. var. **ophioides** Fern. Cold woods; rare. Mount Oneida, *Saunders* (St. B 879) (as *Epipactis tessellata*). Reported from Salamanca by Day, but no supporting specimen found (House and Gordon, 1940).

Habenaria clavellata (Mx.) Spreng. Bogs; scarce. Mount Moriah Swamp, *E et al.* (St. B 3069); observed at Bear Bog. Reported only from the vicinity of the Steamburg Bogs. Frequent in the State.

H. flava (L.) R. Br. var. **herbiola** (R. Br.) Ames & Correll (var. *virescens*). Swampy meadows; rare. Large colony in the Tunungwant Valley, near Limestone, *S & F* 23165; *S et al.* 23535. The plants varied greatly in size and most of them seemed to have two or three large leaves abruptly succeeded by much smaller bracteal leaves; the petal-shape, however, agreed with var. *herbiola*, as figured by Correll (1951). The specimen from Rush Run, the only earlier collection, has the leaves more gradually reduced as required by Fernald (1950) for var. *herbiola*. From the specimens in the State herbarium, there is too much variation in this characteristic for it to be useful. Local in the State.

* **H. hyperborea** (L.) R. Br. var. **huronensis** (Nutt.) Farw. (*H. hyperborea auct.*, p. p.). Meadows bordering bogs; rare. North of Steamburg, *S et al.* 24390. This is at the southern border of the range of the species.

H. lacera (Mx.) Lodd. Moist places; rare. Meadow bordering bog, north of Steamburg, *S et al.* 23228. Previously reported only from Mount Moriah Swamp and Seneca Mountain. Frequent in the State.

Liparis loeselii (L.) L. C. Richard. Boggy woods and swaly meadows; rare. South side of Conewango, *S & Ketchledge* 25830. Reported from the Balsam Swamp at Red House. Locally frequent statewide, except in the mountains.

Spiranthes cernua (L.) L. C. Richard. Swaly meadows and ditches; scarce. South side of Conewango, *S & Ketchledge* 25829; observed at mouth of Tenmile Creek. Reported from St. Bonaventure, Blacksnake Mountain and from the Town of Carrollton; the latter specimens are from Weaver Draw, Tenmile Valley. Common in the State.

* **Populus deltoides** Marsh. Streambottoms; possibly frequent. Islands below Red House, *S et al.* 23604; observed at Peth. New to Cattaraugus County; also collected, outside the immediate area, on the south edge of Otto, *S et al.* 23727. Common along the larger streams of the State.

Salix interior Rowlee. Gravelbars; local. Islands below Red House, *S et al.* 23605; Oldtown, *S et al.* 24475. Previously reported only from Onoville. Not uncommon on bars at the lower elevations in central and western New York; local eastward.

Comptonia peregrina (L.) Coult. var. **peregrina** (*Myrica asplenifolia auct.*, p. p.; *M. asplenifolia* var. *tomentosa*). Dry fields; locally common as stated. Additional stations are: Allegany, *anon.* (St. B 1004); Red House, *Fenton* 170; observed east of Vandalia. Not uncommon in many parts of the State on sterile soils; var. *asplenifolia* (L.) Fern. only on Long Island.

Carya cordiformis (Wang.) K. Koch. Woods; not uncommon along the river and occasional in uplands nearby. Horseshoe, *S et al.* 27750; river islands below Red House, *S et al.* 23600; Pierce's Run, *Fenton*

459; observed east of Russell and at Killbuck. Frequent statewide, outside of the mountains.

Carya glabra (Mill.) Sweet. Open oak woods; occasional. Killbuck, *S et al.* 27713; observed at Riverside Junction. Reported only from Quaker Bridge and from moist woods. About the same range as the last.

Carpinus caroliniana Walt. var. **virginiana** (Marsh.) Fern. (*C. caroliniana*, *p. p.*, Gleason, 1952). Woods and thickets; not as infrequent as indicated. Observed at the following stations: Limestone, east of Vandalia, Horseshoe, north of Steamburg, Elko, Frecks. Common in the State.

Corylus cornuta Marsh. Woods and thickets; a few more stations on the east side of the area. St. Bonaventure, *E et al.* (St. B 1027, 1028); Allegany, *anon.* (St. B 1029); observed at Riverside Junction. Frequent in the State, except for the Coastal Plain, where rare.

Quercus prinoides Willd. Dry thickets; rare. Near Red House, Knobloch 503. Previously reported from terrace north of Onoville. Both specimens consist of leafy shoots with very young fruits. They have the leafhairs and the leafmargins of this species as prescribed by Dyal (1936). These are the only stations in western New York; local in western Pennsylvania.

Ulmus rubra Muhl. (*U. fulva*). Low woods; possibly frequent, but not as gregarious as *U. americana* L. (a situation prevailing over most of the lowlands of New York). St. Bonaventure, *E et al.* (St. B 1141, 1142, 1211); Horseshoe, *S & E* 26402; observed at Riverside Junction. Previously reported only from Quaker Bridge. *U. rubra* seems to be absent from higher elevations in this State, where *U. americana* can be found (except for the highest).

Comandra umbellata (L.) Nutt. Dry woods and thickets; more common than indicated. Allegany, *anon.* (St. B 1154); Vandalia, *E* (St. B 1214); Killbuck, *S & E* 26471; Quaker Bridge, *Alexander & House* 12545. Frequent at lower elevations in the State.

Asarum canadense L. var. **reflexum** (Bickn.) Robinson (*A. reflexum*). Bottom land woods; rare. South Vandalia Oxbow, *S & E* 27996; Horseshoe, *S & E* 26363. Previously reported only from Quaker Run. Very local in the State: vicinity of New York City; drainage of Seneca River; western New York. This investigator can see little distinctive in New York material of var. *acuminatum* (Ashe) Bickn., so labeled, other than the more caudate tips of the calyx-lobes. Var. *reflexum*, on the other hand, has a number of characteristics. The rhizomes are slender; the leaves average smaller; the flowers are smaller, with prominently reflexed lobes. In the field, at flowering time, the leaves appear a brighter yellow-green, the young ones not grayish; the flowers are a brighter "brick-red," with more yellow in the pigmentation and the area of white inside the calyx is greater. In the areas where the var. *reflexum* has been seen in New York State, the var. *canadense* (incl. var. *acuminatum*) could not be found closely associated but was frequently in upland areas nearby.

Polygonum arifolium L. var. **pubescens** (Keller) Fern. (*P. arifolium auct.*). Bogs; rare. A new station east of the others: Mount Moriah Swamp, *S & E* 26291. Frequent in the lowlands of the State, south of the Adirondacks.

P. cilinode Mx. Bottom lands; common. Horseshoe, *S & E* 26408; mouth of State Line Run, *S & F* 23231; observed at Carrollton, Riverside Junction, islands below Red House and Oldtown. Dry habitats are usually emphasized for this species. It should be noted that the colonies on these bottoms are frequently extensive and luxuriant. Locally frequent in the counties bordering Pennsylvania.

P. hydropiperoides Mx. subsp. **hydropiperoides** (Stone, 1911). Sloughs; a new station. Horseshoe, *S & E* 27768. Considered common by McVaugh (1938).

P. scandens L. Bottom lands; four more stations. Horseshoe, *S et al.* 27767; observed at lower Quaker Run. Oldtown and mouth of State Line Run.

* **Rumex altissimus** Wood. Alluvial woods; rare. Islands below Red House, *S et al.* 23609. "Rosettes" observed at Horseshoe, May 28, 1958, were probably this. Specimens collected in similar habitats in the Susquehanna drainage east of the area lead the investigator to suspect that it may be native in such areas. Jennings does not list it for the High Plateau.

Claytonia virginica L. Frequent on bottom lands, at least above Salamanca. Allegany, *anon.* (St. B 1226); St. Bonaventure, *E & Yackovich* (St. B 1222); Horseshoe, *S & E* 26406; observed at South Vandalia Oxbow. Reported previously only from Wolf Run. This species is more restricted in range in this State, being found primarily in more alluvial situations, in the experience of the author, than *C. caroliniana* Mx.

Arenaria lateriflora L. Low woods and grassy fields; infrequent. New stations upriver. South Vandalia Oxbow, *S & E* 26318; lower Ten-mile Creek, *S & E* 24936; Horseshoe, *S & E* 26405. The grassy field habitat is one to add to those mentioned by House and Gordon.

* **Cerastium nutans** Raf. Springy grassy banks; rare. North of Cold Spring, *S & E* 24955, where luxuriant. Jennings thinks it weedy and considers it rare in northwestern Pennsylvania. Zenkert reports this only from the escarpment east of Buffalo. Rare in south-central New York.

Paronychia canadensis (L.) Wood (*Anychia canadensis*). Dry oak woods; apparently rare, but possibly overlooked. Killbuck, *S & E* 26483; *S et al.* 27727. Previously reported from just west of Bradford (Riverside) Junction. The only other report for the State west of the Finger Lakes is at Scottsville, Monroe County. Jennings points out its rarity in the northern part of his area.

Silene antirrhina L. Native in the region (?). Dry oak woods; scarce. Killbuck, observed. Previously reported as an infrequent weed along railroads. Again, apparently rare to the south of area.

S. stellata (L.) Ait. f. Open woods; additional stations upriver. St. Bonaventure, *E et al.* (St. B 1248, 1249); one-half mile west of Bradford (Riverside) Junction, *Gordon* (St. B 1251); observed at Killbuck. Infrequent across the State, south of the mountains.

Stellaria longifolia Muhl. Moist places; not infrequent near the river. Mount Moriah Swamp, *S & E* 26289; Horseshoe, *S & E* 26404; opposite Red House, *S & E* 24979; south side of Conewango, *S et al.* 22642; observed at Riverside Junction and lower Tenmile Creek. Previously reported only from Quaker Run.

Nuphar luteum (L.) Sibth. & Sm. subsp. **macrophyllum** (Small) Beal (*Nymphaea advena*; *Nuphar advena*—Beal, 1956). Occasional in the larger valleys. Observed at Limestone and Horseshoe. Reported from Riverside Junction. Not listed by McVaugh (1938).

* **N. luteum** (L.) Sibth. & Sm. subsp. **variegatum** (Engelm.) Beal (*N. variegatum*—Beal, 1956). Lakes and ponds; occasional. Lakeshore, Allegany State Park, *Yackovich et al.* (St. B 1261); observed in Red Pond. Considered common by McVaugh (1938). Subsp. *macrophyllum* is more southern in distribution than subsp. *variegatum*.

Anemonella thalictroides (L.) Spach. Open oak woods; rare. Allegany, *anon.* (St. B. 1283); St. Bonaventure, *E et al.* (St. B 1282, 1284, 1285). Reported only from the vicinity of Red House.

Caltha palustris L. Scarce. A new station. Mount Moriah Swamp, *S & E* 26277.

Hepatica americana (DC) Ker. Open oak woods; not infrequent. One and one-half miles north of St. Bonaventure, *E & Donahue* (St. B 1286); Killbuck, *S & E* 26460; observed east of Vandalia and at Riverside Junction.

* **Ranunculus abortivus** L. var. **acrolasius** Fern. Open woods and seepage banks; at least occasional. St. Bonaventure, *E & Ellis* (St. B 3088); Horseshoe, *S & E* 26360; vicinity of Cold Spring, *S & E* 24952. Benson (1948) considered this variety interesting because of apparently distinctive range but unworthy of nomenclatorial rank because based on only one character; he recognized var. *eucyclus* because it was based on two characters. Fassett (1942), in using mass collections, considered var. *eucyclus* trivial but recognized var. *acrolasius* as a geographic race. The pubescence is sparse and may disappear in age; transplant-studies might solve the problem. Var. *acrolasius* is reported from western New York.

R. ambigens S. Wats. (*R. laxicaulis* auct.). Bottom lands; rare. Cold Spring, *Alexander*, August 16, 1927. Reported from the Tungungwant Valley and from Salamanca; also from Portville to the east (McVaugh, 1938).

* **R. hispidus** Mx. var. **hispidus**. Swampy woods and bottom lands; rare. South Vandalia Oxbow, *S & E* 26313; Riverside Junction, *S & E* 25003; observed at Horseshoe. The collected specimens, at least, have small flowers, much-dissected leaves and are rather tall; they resemble a photograph of *R. hirtipes* Greene in the files of the New York State Museum. Benson (1948) refers *R. hirtipes* to the present taxon.

R. hispidus Mx. var. **falsus** Fern. (*R. hispidus* auct., p. p.—Benson, 1948, 1954). Dryish open woods and nearby banks; frequent. St. Bonaventure, *E et al.* (St. B 1269); Riverside Junction, *S & E* 25004; Killbuck, *S & E* 26458, 26459; opposite Red House, *S & E* 24965; observed at Vandalia and east. Previously reported only from near Quaker Bridge. The range of the variants of *R. hispidus* in this State is difficult to state at this time, due to confusion in older records.

R. septentrionalis Poir. var. **septentrionalis**. Sloughs and stream-margins; common in the bottom lands. Mount Moriah Swamp, *S & E* 26278; Horseshoe, *S & E* 26356, 26358; observed at many sites. Considered infrequent by House and Alexander.

Lindera benzoin (L.) Blume var. **benzoin** (*Benzoin aestivale*). Low woods; two more stations. Observed in Mount Moriah Swamp and at South Vandalia Oxbow. This species is found in the lowlands throughout much of upstate New York but frequently dies to the ground after severe winters.

Sanguinaria canadensis L. var. **canadensis**. Low woods; probably frequent near the river. Horseshoe, *S & E* 26364; south of Quaker Bridge, *S et al.* 22690; observed on the islands below Red House. Previously reported from Onoville (Fenton, 1949) and Red House.

* **Arabis canadensis** L. Open oak woods; rare (?). Killbuck, *S et al.* 27708. Infrequent in western New York.

Cardamine bulbosa (Schreb.) BSP. Alluvial woods; rare. Riverside Junction, *S & E* 25007; Horseshoe, *S & E* 26366. Numerous individuals were present in each colony.

C. douglassii (Torr.) Britton. Springy thickets; rare. Observed along Tenmile Creek in great abundance. Previously reported only from Red House Valley. This and the preceding need to be restudied throughout their ranges in this State.

C. rotundifolia Mx. Springy woods and banks; a new station. Seepage bank opposite Red House, *S & E* 24966. In New York State, restricted to the southwestern corner.

* **Erysimum cheiranthoides** L. Occasional. River gravels near Quaker Bridge, *Saunders*, July 31, 1940. Generally distributed about the State except for Long Island; frequently weedy.

* **Agrimonia pubescens** Wallr. Thickets in oak barrens; rare. South of Quaker Bridge, *S & F* 23246. The distribution of the Agrimonia in this State is imperfectly known.

Geum laciniatum Murr. (*G. virginianum* auct.). Moist meadows and thickets; more frequent than indicated. Observed in several places from Limestone to Killbuck. Common throughout most of New York State, at least in the lowlands.

Pyrus floribunda Lindl. (*Aronia arbutifolia* auct., p. p.; *A. prunifolia*). Bogs; scarce. Allegany, anon. (St. B 1500); *E et al.* (St. B 1498); observed in bogs, north of Steamburg. Such specimens as had flowers or fruits had nonglandular calyx-lobes; all are sparsely hairy. Gordon's specimens from Owlensburg Bog and some from the "Rock Cities" to the east also belong here.

Rosa palustris Marsh. Marshes; scarce. Allegany, anon. (St. B 1589). Previously reported only from Limestone. Not uncommon in many parts of the State in swales and marshes.

* **Rubus canadensis** L. Old fields and river thickets; probably overlooked. Cold Spring, *Fenton* 55; Quaker Bridge, *S & F* 23483. Not uncommon upstate, but mostly at higher elevations than *R. allegheniensis*.

R. occidentalis L. Old fields, waste places and thickets; frequent. Several observations were made from Allegany to Elko. Frequent in the State outside of the mountains.

* **R. × permixtus** Blanch. (*allegheniensis* × *hispidus*). Boggy woods; rare. St. Bonaventure, *S & E* 24939, Fernald (1950) considers this a species; Gleason (1952) includes it in his collective *R. hispidus* L. It is local wherever the two alleged parents are found.

Spiraea alba du Roi. Riverbottom swales, etc.; occasional. St. Bonaventure, *anon.* (St. B 1483); *E et al.* (St. B 1481); west of Vandalia, *S & F* 23710; Horseshoe, *S et al.* 26393; observed at East Randolph. This is a frequent shrub in central and western New York.

* **Baptisia tinctoria** (L.) R. Br. var. **projecta** Fern. New to the State. Dry banks; rare. North of Quaker Bridge, *S et al.* 22596, 22722. These plants had flowering racemes up to 40 cm. long and large flowers for the species. They were collected June 18-19 in a large colony of nonflowering individuals. These latter flowered two to three weeks later and were normal var. *tinctoria* (incl. var. *crebra* Fern.—Clausen, 1944). Known north to central Pennsylvania.

Desmodium cuspidatum (Muhl.) Loud. (*D. bracteosum*). Steep rocky oak woods; a new station. Killbuck, *S et al.* 27724.

D. nudiflorum (L.) DC. Open oak woods; scarce. Three more stations: Killbuck, *S et al.* 27725; southwest of Quaker Bridge, *S & F* 24497; observed east of Vandalia.

D. rotundifolium DC. Open oak woods; infrequent. Two more stations. Riverside Junction, *S et al.* 23112; observed southwest of Quaker Bridge. The specimens of all the species of *Desmodium* should be restudied and much more collecting must be done before adequate statements of range can be made.

Lathyrus ochroleucus Hook. Dry woods and banks nearby; probably frequent. One-half mile east of Vandalia, *E* (St. B 3115); Riverside Junction, *S & E* 25013; observed at Vandalia and Killbuck. Previously reported from Carrollton and Butler Run. The abundance of this species increases westward in the State.

Lespedeza capitata Mx. Dry fields; frequent. St. Bonaventure, *E et al.* (St. B 1688); Horseshoe, *S et al.* 26397, 27762; Cold Spring, *Alexander & House* 12796; south of Quaker Bridge, *S et al.* 24468. Previously reported only from Elko.

L. intermedia (S. Wats.) Britton. Open oak woods and thickets; infrequent. Two new stations: Killbuck, *S et al.* 27726; Red Pond, *S et al.* 23766. The total range of the species of *Lespedeza*, like that of the species of *Desmodium*, covers the State south of the Adirondacks and outside of the Catskills. They become increasingly scarce at the higher elevations.

Lupinus perennis L. subsp. **perennis** (Phillips—1955). Oak woods and sandy barrens; rare. A single large clump, east of Riverside Junction (a new station), *S & E* 26338. This species has much the same general range as that of the two genera just mentioned.

Polygala senega L. Edge of oak woods; rare. Opposite Red House, *S & E* 24969. Reported from Quaker Bridge. Rather rare in western New York.

Acalypha rhomboidea Raf. (*A. virginica* auct.). Dry soil; infrequent, as stated. West of Red House, *S et al.* 24417; observed at Killbuck and Quaker Bridge. House considers it frequent or common across the State.

* **Callitriche palustris** L. Moist soil about water; probably overlooked. On mud of emptied pond, East Randolph, *S et al.* 24453. Not listed by McVaugh (1938).

Floerkea proserpinacoides Willd. Alluvial woods and seepage banks; probably frequent in the river valley. Riverside Junction, *S & E* 25011; Horseshoe, *S & E* 26379; north of Cold Spring, *S & E* 24954. Previously reported only from Red House. The author considers this to be one of the most commonly overlooked species. It is not uncommon in central New York. Zenkert considers it infrequent in western New York and Jennings thinks that it is relatively absent from the northern part of the High Plateau.

Rhus typhina Torner (Barkley, 1937). Dry thickets; frequent. Observed from Allegany to Elko; definitely cited only from Quaker Bridge. Considered common throughout the State except for Long Island.

R. glabra L. Dry thickets; locally frequent. Observed at several places from Red House to Elko. Frequent or common throughout most of the State.

R. vernix L. Bogs; rare. Balsam Swamp, Red House, *Riccardo* (St. B 1742); *Vecchierello* (St. B 1741). Also reported from Mount Moriah Swamp and the bogs about Steamburg and Randolph. Locally common throughout the State except for the higher Adirondacks.

Acer nigrum Mx. f. var. **nigrum** (Fosberg, 1954). Low woods; not infrequent. Vandalia, *E* (St. B 1786); Tunungwant Valley, *Alexander* (St. B. 1782); Horseshoe, *S & E* 26381; Killbuck, *S & E* 26472; *S et al.* 27712; Oldtown, *S et al.* 23794; observed at Riverside Junction. Reported from "Allegany State Park," without further designation of localities. The problem of subspecies has been discussed by Desmerais (1952), but this investigator agrees with Fosberg (1954) and Clausen (1949) on the choice of specific name.

Rhamnus alnifolia l'Her. Wooded swamps; rare. Mount Moriah Swamp, *E* (St. B 1749). Previously reported only from Red House. Infrequent in western New York.

Hypericum pyramidatum Ait. (*H. ascyron*). Riverbanks; rare. Horseshoe, *S & E* 26375. Previously reported from Elko and a swamp near Randolph. Rare to infrequent throughout the lowlands of upstate New York.

* **H. canadense** L. Cultivated fields; rare. Vicinity of Red Pond, *S et al.* 23756. This species is common only in the Adirondacks and on Long Island; it is scarce to rare elsewhere in the State. The only other record from western New York is an unconfirmed one for Niagara Falls. Jennings considers it rare; his closest station would be Presque Isle, Pa.

* **H. virginicum** L. var. **fraseri** (Spach) Fern. (*Triadenum fraseri*) Swamps and bogs; scarce. Tunungwant Valley, *anon.* (St. B 1854). Reported from the bogs about Steamburg as *H. virginicum*. The specimens from Allenberg (Owlenburg) Bog are all var. *virginicum*. Jennings (1953) allows both varieties to cover the area but with different frequencies. Gleason (1952) thinks them worthy of specific rank.

* **Viola affinis** Le Conte. Old fields; rare. Pasture at edge of Mount Moriah Swamp, *S & E* 26281. Frequent in western New York; possibly overlooked in western Pennsylvania.

V. fimbriatula Sm. Old fields; rare. Pasture at edge of Mount Moriah Swamp, *S & E* 26282. Reported from the vicinity of Vandalia. Rather rare in western New York.

* *V. sagittata* Ait. Old fields; rare. Vicinity of bogs, north of Steamburg, *S & F* 23754; *S & Schumacher* 24386, 24387. Frequent in the middle Hudson Valley and on parts of Long Island; rare elsewhere in the State. Rare or infrequent on the High Plateau to the south.

V. sororia Willd. Alluvial bottom lands; frequent as elsewhere in the State in such habitats. South Vandalia Oxbow, *S & E* 26314; Horseshoe, *S et al.* 26369, 27746; Elko, *S et al.* 22691, 22747; observed at Carrollton and Quaker Bridge, on the islands below Red House and at Oldtown. Reported as infrequent.

V. striata Ait. Bottom land woods; scarce. Across the river from St. Bonaventure, *Donahue & E* (St. B 3135); Horseshoe, *S & E* 26367. Reported only from Quaker Run. Common in western Pennsylvania; infrequent in the Niagara Frontier.

Angelica atropurpurea L. var. *atropurpurea* (*A. atropurpurea*, *p. p.*, of Gleason, 1952). Bottom lands; frequent along the river. Observed at South Vandalia Oxbow, Riverside Junction, Horseshoe, Quaker Bridge and Oldtown. Previously reported as rare, the only cited stations being Cold Spring and Randolph. Relatively common throughout most of New York.

Heracleum lanatum Mx. (*H. maximum*). Bottom lands; frequent along the river. Observed at Vandalia, South Vandalia, Horseshoe and Quaker Bridge. Definitely cited only from Cold Spring. Frequent across the State.

Osmorrhiza longistylis (Torr.) D. C. Woods and thickets; apparently rare. Allegany, *anon.* (St. B 2041). Reported from Quaker Bridge. Not as common as *O. claytonii* (Mx.) Clarke in this State.

Cornus alba L. subsp. *stolonifera* (Mx.) Wangerin (*C. stolonifera*—Clausen, 1949). Riverbottom thickets; rare. One-half mile west of Allegany, *E*, Sept. 23, 1956 (St. B); Quaker Bridge, *Fenton* 448. Generally common, upstate. Jennings suggests that it is not native except in the glaciated area. Previously reported from the driftbogs around Randolph.

* *C. drummondii* C. A. Meyer. Bottom land thickets; rare. Cold Spring, *Fenton* 11. The only other record for New York State is on the Cattaraugus Indian Reservation near Gowanda, Erie County, whence it was reported as *C. asperifolia*. This may have been brought in by the Iroquois, who used it in medicine.

Monotropa hypopitys L. subsp. *lanuginosa* (Mx.) Breitung (*M. hypopitys* and *M. hypopitys auct. amer.*—Breitung, 1957). Acid woods; infrequent. Tenmile Hollow, *E* (St. B 3198, 3199); Riverside Junction, *S et al.* 23110; observed east of Vandalia and at Killbuck. Reported as infrequent; these new stations are all on the northwest corner of the range.

Vaccinium corymbosum L. Wet woods; scarce. St. Bonaventure, *E et al.* (St. B 2167); Mount Moriah Swamp, *S & E* 26283. Previously reported only from the Steamburg Bogs.

V. stamineum L. Dry open woods and old fields; infrequent. St. Bonaventure, *E et al.* 2158, 2180; Allegany, *anon.* (St. B 2183); one and one-half miles from St. Bonaventure, *E & Donahue* (St. B 2187); Killbuck, *S & E* 26470. Earlier stations were all from the west side of the Park.

* **Fraxinus pennsylvanica** Marsh. subsp. **pennsylvanica** (Miller, 1955). Bottom land woods; probably frequent. Carrollton, *S & F* 23385; Horseshoe, *S & E* 26372; west of Red House, *S & F* 23778; islands below Red House, *S et al.* 23590. The specimen from Horseshoe was downy; all others were nearly glabrous. The glabrate variant was also observed at Horseshoe. The trees from west of Red House had abundant fruit; none of the others had either flowers or fruit. All showed the distinctive epidermal pattern on the dorsal leaflet-surfaces. Frequent in western New York.

Bartonia virginica (L.) BSP. Acid soil; rare. Gravelly terrace, oak barrens, north of Onoville, *Saunders* (St. B 2215). Previously reported only from the Steamburg Bogs. Infrequent in western New York.

* **Apocynum cannabinum** L. Gravelbars and poor soil; infrequent. St. Bonaventure, *E et al.* (St. B 2232); islands below Red House, *S et al.* 23591.

* **A. × medium** Greene (*androsaemifolium* × *cannabinum* or *sibiricum*). Poor soil; occasional. Allegany, *anon.* (St. B 2227, 2234); Carrollton, *S & F* 23389.

* **A. sibiricum** Jacq. var. **sibiricum**. Poor soil; frequent. St. Bonaventure, *anon.* (St. B 2230); near Holts Run, *Daniels et al.* (St. B 2228); near Elko, *Hicks* (St. B 2229); Elko, *S et al.* 22755; observed at Oldtown. The Hicks and Daniels specimens were both labeled *A. cannabinum* and apparently were the vouchers for that species in the original report. Details of distribution of these Indian hems in western New York await more and better collections.

Asclepias quadrifolia Jacq. Open oak woods; rare. Killbuck, *S & E* 26469; *S et al.* 27711. The only earlier report is an old one from Salamanca. Rare in western New York; frequent in western Pennsylvania but less common on the High Plateau.

Convolvulus spithameus L. Dry gravelly soil; local. Killbuck, *S & E* 26484. Reported only from the vicinity of Red House. Rare in western New York; not reported from the northern High Plateau in western Pennsylvania.

Phlox maculata L. subsp. **maculata** (Wherry, 1951). Roadside ditches and swales; local. St. Bonaventure, *Vecchierello*, May 15, 1924; opposite Red House, *S & F*, 23072; Red House Valley, *Porter* (St. B 2340). Reported only from Quaker Bridge and vicinity. These stations are on the north edge of the native range. Rare in New York State; common to the south.

Polemonium reptans L. Springy woods, thickets, banks; frequent in the larger valleys. Additional stations are: St. Bonaventure, *E et al.* (St. B 2332); Allegany, *anon.* (St. B 2331); observed at South Vandalia Oxbow, Carrollton, Horseshoe, west of Red House and north of Elko. Common in the lower Chemung Valley, the Genesee Valley and the Allegheny drainage in New York State.

Agastache scrophulariifolia (Willd.) Ktze. Edge of bottom land woods and thickets; rare. Horseshoe, *S et al.* 27781; Oldtown, *S et al.* 23501. Infrequent or rare throughout most of the State. Widely scattered and infrequent in western Pennsylvania.

Lycopus virginicus L. Moist places, in shade or open; rare—a second station. St. Bonaventure, *E et al.* (St. B 2298). Reported from

Red House Creek. Infrequent in western New York.

Monarda clinopodia L. Low woods and thickets, moist or dry; infrequent. West of Red House, *S et al.* 24398; south of Quaker Bridge, *S & F* 23243; Oldtown, *S et al.* 23503; observed at Killbuck. Reported from Carrollton, Cold Spring and Quaker Bridge. In New York State known only from Tioga, Tompkins and Monroe Counties westward.

* **Pycnanthemum incanum** (L.) Mx. Steep slopes in oak woods; rare. Killbuck, *S et al.* 27730. Not infrequent south of Lake Ontario and the Mohawk River except for the Catskills and extreme western New York; infrequent on the High Plateau just south.

Teucrium canadense L. (incl. varieties and *T. occidentale*—McClintock & Epling, 1946). Habitat as cited; scarce. New stations are: Horseshoe, *S et al.* 27780; islands below Red House, *S et al.* 23611; near Onoville, *Gordon* (St. B 2241). Frequent in western New York.

* **Chelone glabra** L. subsp. **elatior** (Raf.) Pennell. New to the State; bottom land woods; rare. Horseshoe, *S et al.* 27779. This record is based on two plants growing in a colony of normal subsp. *glabra*. They were several inches taller, with corollas entirely rose, externally; the leaves were thinner with longer petioles and were more incised-serrate. They were a good match for Jennings' plate of subsp. *elatior* (1953). According to Pennell's maps and cited specimens (1935), this is new to New York State, but Fernald (1950) extends the range to New Hampshire, including his own f. *rosea*. Pennell does not cite this latter name in synonymy or the index but refers the type (indicated by footnote) to subsp. *glabra*. Fernald emphasizes the thinness of the leaves. Gleason (1952) points out the overlapping of range of all other races with the nominal race. Here, at least, there were no intermediates. The isolating mechanism was not apparent.

Lindernia dubia (L.) Pennell (*Ilysanthes dubia*). Gravelbars and muddy borders of pools; scarce. Horseshoe, *S et al.* 27777, 27778; river islands below Red House, *S et al.* 23610; observed at East Randolph. Reported from Fivemile Creek and from near Cold Spring. Rare in western New York; frequent in western Pennsylvania. The plants from the mudsites had larger, thinner leaves with more rounded bases and more prominently toothed margins; they showed no tendency to reduction of upper leaves. The plants from the gravelbars had thicker leaves with somewhat narrowed bases and these were nearly entire; the older plants showed signs of reduction of the upper leaves. All the specimens had pedicels varying from 5-12 mm. in length. Controlled plantings of this species might serve to clarify the worth of the subspecies or varieties which are distinguished.

* **Melampyrum lineare** Desr. var. **latifolium** Bart. Open oak woods; rare. Riverside Junction, *S & F* 23114. This is good material of the variety. Most of the plants from this region, which would be placed under subsp. *latifolium* (Muhl.) S60 by Pennell (1935), are referable to var. *americanum* (Mx.) Beauverd. It is interesting that the range of var. *americanum* strongly overlaps that of the other races (Gleason, 1952).

Veronica scutellata L. Marshes; infrequent. Vicinity of Limestone, *S & F* 23153; *S et al.* 23524; South Vandalia Oxbow, *S & E* 26322; Pickup's Pond, Randolph, *Porter et al.* (St. B 2396); near Onoville,

Gordon (St. B 2395); observed at Carrollton. Definitely cited only from vicinity of Cold Spring and Quaker Bridge. Infrequent in western New York.

Utricularia vulgaris L. subsp. *macrorrhiza* (Le Conte) Clausen (*U. macrorrhiza*; *U. vulgaris* auct. amer.—Clausen, 1949). Oxbows; rare. South Vandalia, *S & E* 26323. Reported from the Tunungwant Valley. Common in the watershed (McVaugh, 1938), but cited specifically only from the lakes.

Phryma leptostachya L. Open oak woods; rare, but possibly overlooked. Killbuck, *S et al.* 27728. Probably frequent outside of the mountains. Reported from the vicinity of Limestone and of Randolph.

Cephalanthus occidentalis L. Oxbows along the river; local. Observed at South Vandalia, Vandalia and Horseshoe. Reported only from Allegany and Randolph. Frequent in western New York.

* *Galium pilosum* Ait. subsp. *pilosum* (Stone—1911). Open oak woods; rare. Riverside Junction, *S et al.* 23107. This species is local in the State and rather rare in western New York. Apparently rare in northwestern Pennsylvania.

Lonicera dioica L. var. *dioica*. Open woods; rare. St. Bonaventure, *E et al.* (St. B 2481). Otherwise known only from the benches opposite Red House. Frequent in western New York.

* *L. sempervirens* L. Woods; rare. Elko Mountain, *Gordon et al.* (St. B 2476) (as *L. dioica*). Several scattered stations about the Allegheny Plateau; more frequent on Long Island. Jennings cites it as rare and suggests it is an escape.

Triosteum perfoliatum L. var. *aurantiacum* (Bickn.) Wieg. (*T. perfoliatum* auct., p. p.; *T. aurantiacum*). Open oak woods and bottom land thickets; more frequent than indicated. Carrollton, *S & F* 23386; Horseshoe, *S & E* 26373; Killbuck, *S & E* 26467; *S et al.* 27709; west of Red House, *S et al.* 24416; Elko, *S et al.* 22750; observed at Riverside Junction and opposite Red House. Reported from St. Bonaventure, Quaker Run and Peters Run. Infrequent in western New York.

Viburnum opulus L. subsp. *trilobum* (Marsh.) Clausen (*V. opulus* auct.; *V. trilobum*; *V. opulus* var. *americanum*—Clausen, 1949). Bottom land woods; two more stations. Carrollton, *S & F* 23396; Horseshoe, *S et al.* 23469. Infrequent in western New York. The specimens found by this investigator were near the sites of longhouses. It is possible the species was planted by the Iroquois.

Aster lowricanus Porter. Open oak woods; local. Killbuck, *S et al.* 27720. Reported only from near Red House and as frequent in the park (Knobloch, 1937). Rare (?) in western New York, but common in western Pennsylvania.

A. novae-angliae L. Bottom lands; rare as stated. Observed at Horseshoe and Vandalia. No stations were cited, previously. Common in most of the lowlands of the State; common in western Pennsylvania. Its rarity in this valley is unexplainable at present.

A. paternus Cronquist (*Sericocarpus asteroides*). Open oak woods, etc.; infrequent. Observed at a new station upriver from the others; Killbuck. Rare in western New York; common in the uplands of western Pennsylvania.

A. sagittifolius Wedem. Dry old fields and open woods; frequent near the River. Killbuck, *S et al.* 27719; west of Red House, *S & F* 24425; Cold Spring, *S et al.* 22672; observed at Horseshoe. Previously reported only from Sunfish Run, near Red House and the vicinity of Elko (Knobloch, 1937, *inter aliis*). Common in western New York.

* **Bidens comosa** (Gray) Wieg. (incl. in *B. tripartita* by Cronquist—Gleason, 1952). Mucky places along the river; rare. Horseshoe, *S et al.* 27752. Frequent in western New York.

B. vulgata Greene. In similar habitats; infrequent. Two more stations, upriver. Killbuck, *S et al.* 27714; observed at Horseshoe. Frequent in western New York.

Cacalia suaveolens L. Bottom land woods; scarce. Horseshoe, *S & E* 26384; river islands below Red House, *S et al.* 23602, 23716; between Quaker Bridge and Cold Spring, *Alexander*, August 25, 1927; south of Quaker Bridge, *Saunders* (St. B 2776). Rare according to Zenkert, who considers it adventive; not common in western Pennsylvania.

* **Cirsium discolor** (Muhl.) Spreng. Fields and thickets near the river; frequent as in other large valleys of the State. North of Cold Spring, *S et al.* 23786; Elko, *S et al.* 22761; near Allegheny River, Allegheny State Park, *Wagner* (St. B 2790); observed at Horseshoe, west of Red House, south of Steamburg and at Oldtown. The Wagner specimen was labeled *C. lanceolatum*.

* **C. pumilum** (Nutt.) Spreng. (*C. odoratum*). Old fields; scarce. Red House Lake, *S et al.* 23715; near bogs north of Steamburg, *S et al.* 23761; observed at Oldtown. Originally reported from Quaker Run, but this record was deleted later. Possibly new to western New York, the only earlier record being doubtful (Zenkert, 1934).

* **Erigeron philadelphicus** L. Fields and waste places; rare (?) Allegany, *anon.* (St. B 2710). Frequent in most parts of the State, outside the mountains; infrequent on the High Plateau.

E. pulchellus Mx. Open oak woods; scarce. Killbuck, *S et al.* 26474; observed opposite Red House. Reported from "Allegheny State Park" and St. Bonaventure. Jennings says: "avoiding the High Plateau."

Eupatorium fistulosum Barratt (*E. purpureum* auct., p. p.). Low grounds; rare. Quaker Bridge, *Alexander*, August 26, 1926; near Kents Corners, *Fenton* 102; observed north of Quaker Bridge. This should be the *E. purpureum sensu* Wiegand of the House and Alexander flora, but not all the specimens so named belong here. This striking species is certainly local; Jennings, who has made a special study of the complex, found no specimens from southwestern New York. *E. maculatum* L. and true *E. purpureum* L. (*E. falcatum* Mx.) are about equally common in the valley.

Helenium autumnale L. Riverbanks; frequent as elsewhere in the State, outside of the mountains. Several collections and observations were made.

Helianthus decapetalus L. Low grounds; frequent along the river and elsewhere. Cold Spring, *S et al.* 22671; north of Elko, *S et al.* 22698; one mile south of Steamburg, *E & Donahue* (St. B 3217); observed at mouth of Tenmile Creek and at Horseshoe. Reported only from near Elko. Frequent in western New York.

Hieracium venosum L. Open oak woods and banks nearby; not infrequent. New stations east of the park are: one and one-half miles north of St. Bonaventure, *E & Donahue* (St. B 2815); five miles west of Allegany, *E* (St. B 2813); Riverside Junction, *S et al.* 23111; observed east of Allegany. Infrequent in western New York.

Lactuca hirsuta Muhl. Thickets on site of cutover oak woods; rare. Near Red House, *Alexander & House* 12893 (as *L. canadensis*). The specimens belong to f. *calvifolia* Fern. (f. *calvescens*—Fernald, 1920). The species is rare and local in the State as in Pennsylvania. Jennings cites var. *hirsuta* without definite station from "Allegany Park."

Prenanthes altissima L. Woods; more frequent than indicated. St. Bonaventure, *E. H. Donahue* (St. B 2809); Horseshoe, *S et al.* 27753; west of Red House, *S et al.* 24429; observed near Salamanca Rock City. Apparently common in western New York and western Pennsylvania.

* **P. crepidinea** Mx. Thickets in bottom lands; rare. South Vandalia Oxbow, *S & E* 26316; Horseshoe, *S et al.* 26391, 27759. The only previous reports for this State were for Buffalo, where the most recent date of collection known to the author is 1844. Rare in western Pennsylvania. The stations are apparently slightly east of any previously recorded. Both localities are on sites of Indian villages and one wonders if the species were introduced by them.

Senecio obovatus Muhl. Open woods; rare. Killbuck, *S & E* 26473. Although reported as infrequent by House and Alexander, they cite it only from Quaker Run. A third station is known, slightly to the northeast. The species is rare in this State outside of the counties bordering the Hudson. Avoiding the High Plateau, according to Jennings.

Solidago canadensis L. Low woods and thickets near the river; frequent. West of Red House, *S et al.* 24423; observed at Horseshoe and Salamanca Rock City. Reported only from Gardner's Rocks. Common in western New York.

S. patula Muhl. Bogs, swamps and springy places in woods; frequent. Carrollton, *S & F* 23397; Killbuck, *S et al.* 27716; near Onoville, *Gordon* (St. B 2592); observed in Mount Moriah Swamp, at Riverside Junction, about the bogs north of Steamburg and on the south side of Conewango. Previously considered rare and reported only from Sunfish Run. Frequent in western New York.

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An Ecological Survey of Amphibians, Reptiles, and Mammals of Allegany Indian Reservation and Vicinity

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During July and August 1957, a zoological survey was conducted in the Allegheny River Valley, Cattaraugus County. The purpose of the survey was to determine species of amphibians, reptiles, and mammals (primarily small mammals) present in the Allegany Indian Reservation, to check various ecological relationships of these species and to estimate probable effects of flooding on these forms. Birds and fish were not considered in detail since they have been studied by the U.S. Fish and Wildlife Stream Survey and ornithologists working in the area (Cahallane, 1928; Eaton, E. H., 1910, 1914; Eaton, S. W., 1953; Saunders, 1923, 1925, 1936, 1938, 1942).

The project, under the sponsorship of the New York State Museum and Science Service, was carried out by Dr. Margaret Stewart, and assistants Gary Larson and Thomas Watthews. It was completed during the period from July 5-August 28.

A series of areas representing a variety of habitats were chosen for study. Thirty-eight such areas were examined. Many were checked repeatedly over a period of time, especially those in which traplines were set. The majority of study sites were located in the area extending from State Line Road, less than one-quarter mile from the Pennsylvania border on the west side of Allegany State Park, to Red House Station. Several localities outside the area of possible impoundment were examined in order to check for differences in populations and possible habitats for forms which would be forced out of the bottom lands. All reference points correspond to the 1943 U.S.G.S. topographic sheets of Salamanca and Randolph quadrangles.

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The presence and numbers of large mammals were estimated by chance sight, tracks, scats and markings left by the animals. Small mammals were considered more in detail since less work has been done on them in this region. They were taken in traplines or grids of small and large snaptraps baited with a mixture of oatmeal and peanut butter. Measurements and weights, data on reproductive activity, as well as habitat notes, were taken on all small mammals collected, and a representative series of skins was prepared. Complete data sheets and skins have been deposited in the zoology office of the New York State Museum. Ectoparasites were preserved and identified by a specialist. Results are given in table IV. Snakes and salamanders were obtained by turning over rocks, logs and debris in appropriate habitats. Turtles and frogs were taken by surprise with a large dip net or by hand. Only representative samples of each species seen were taken. Most observations were made and data recorded in the field, thereby allowing the animals to remain in their habitats.

Vegetation on the reservation consists primarily of second growth deciduous forests—oak, hickory, beech, birch, maple, hemlock—in the higher woodlands. Along the river there is a border of silver maple, sycamore, and willow interspersed with various other less common species and shrubs. Much of the reservation is either cultivated or abandoned farmland. Abandoned fields are overgrown with weeds, primarily asters and goldenrod, bracken, shrubs, or thickets of oak, wild cherry, sumac and aspen. Detailed information on the vegetation of the region is available in previous museum publications (Gordon, *et al.*, 1937; House and Alexander, 1927; Taylor, 1928).

Shale-covered slopes along roadsides and streams afforded excellent hiding places for snakes. Many small streams, with rubble and shale-covered bottom yielded several species of salamanders. Dry weather, especially during the latter part of the summer, was responsible for the drying of many streams, or "runs," and probably accounted for the difficulty in finding some species which were expected but not seen.

Scientific names of reptiles and amphibians are in accordance with Schmidt (1953) and common names follow those used by the Committee on Herpetological Common Names (1956). Latinized names of mammals follow Miller and Kellogg (1955); common names are those used by Hamilton (1943). Identifications of all animals were made with the aid of appropriate handbooks (see list of references). Where the subspecies of mammals could not be determined without a taxonomic study of a larger series of animals, subspecific names were omitted.

Species seen or taken during the summer are listed. Several animals are known to be present in the area from previous investigations but were not taken during the summer. These are included in a separate listing, with the source of information indicated.

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LIST OF SPECIES TAKEN OR SEEN

Class Amphibia

Salamanders—Order Caudata

Necturus maculosus maculosus Rafinesque—Mudpuppy

Diemictylus viridescens viridescens Rafinesque—Red-spotted Newt, Red Eft

Desmognathus fuscus fuscus Rafinesque—Northern Dusky Salamander

Desmognathus ochrophaeus ochrophaeus Cope—Allegheny Mountain Salamander

Plethodon cinereus cinereus Green—Red-backed Salamander

Plethodon glutinosus glutinosus Green—Slimy Salamander

Plethodon wehrlei Fowler and Dunn—Wehrle's Salamander

Hemidactylium scutatum Schlegel—Four-toed Salamander

Gyrinophilus porphyriticus Green—Northern Spring Salamander

Eurycea bislineata bislineata Green—Northern Two-lined Salamander

Frogs and Toads—Order Salientia

Bufo terrestris americanus Holbrook—American Toad

Hyla crucifer crucifer Wied—Northern Spring Peeper

Rana catesbeiana Shaw—Bullfrog

Rana clamitans Latreille—Green Frog

Rana sylvatica sylvatica Le Conte—Eastern Wood Frog

Rana pipiens pipiens Schreber—Northern Leopard Frog

Rana palustris Le Conte—Pickerel Frog

Class Reptilia

Turtles—Order Chelonia

Chelydra serpentina serpentina Linneaus—Common Snapping Turtle

Chrysemys picta marginata Agassiz—Midland Painted Turtle

Trionyx ferox spinifera LeSueur—Eastern Spiny Soft-shell

Lizards—Order Sauria

Eumeces anthracinus anthracinus Baird—Northern Coal Skink

Snakes—Order Serpentes

- Natrix sipedon sipedon* Linnaeus—Northern Water Snake
Storeria dekayi dekayi Holbrook—Northern Brown Snake
Storeria occipitomaculata occipitomaculata Storer—Northern Red-bellied Snake
Thamnophis brachystoma Cope—Short-headed Garter Snake
Thamnophis sirtalis sirtalis Linnaeus—Eastern Garter Snake
Diadophis punctatus edwardsi Merrem—Northern Ring-necked Snake
Ophedrys vernalis vernalis Harlan—Eastern Smooth Green Snake
Lampropeltis doliata triangulum Lacépède—Eastern Milk Snake
Crotalus horridus horridus Linnaeus—Timber Rattlesnake

Class Mammalia

Order Marsupialia

- Didelphis marsupialis virginiana* Kerr—Opossum

Order Insectivora

- Sorex cinereus cinereus* Kerr—Common Shrew
Sorex fumeus fumeus Miller—Smoky Shrew
Blarina brevicauda Say—Short-tailed Shrew

Order Chiroptera

- Myotis lucifugus lucifugus* LeConte—Little Brown Bat
Pipistrellus subflavus obscurus Miller—Pipistrelle

Order Lagomorpha

- Sylvilagus floridanus* Allen—Eastern Cottontail

Order Rodentia

- Marmota monax rufescens* Howell—Rufescent Woodchuck
Tamias striatus lysteri Richardson—Northeastern Chipmunk
Sciurus carolinensis pennsylvanicus Ord—Northern Gray Squirrel
Tamiasciurus hudsonicus loquax Bangs—Southern Red Squirrel
Castor canadensis Kuhl—Beaver
Peromyscus maniculatus—Deer Mouse
Peromyscus leucopus noveboracensis Fischer—Northern White-footed Mouse
Synaptomys cooperi cooperi Baird—Cooper's Lemming Mouse
Clethrionomys gapperi Vigors—Red-backed Mouse
Microtus pennsylvanicus pennsylvanicus Ord—Field Mouse
Ondatra zibethicus zibethicus Linnaeus—Common Muskrat
Zapus hudsonius hardyi Batchelder—Meadow Jumping Mouse
Napaeozapus insignis insignis Miller—Woodland Jumping Mouse
Erethizon dorsatum dorsatum Linnaeus—Porcupine

Order Carnivora

- Vulpes fulva fulva* Desmarest—Red Fox
Euarctos americanus americanus Pallas—American Black Bear
Procyon lotor lotor Linnaeus—Eastern Raccoon
Mephitis mephitis nigra Peale and Palisot de Beauvois—Eastern Skunk

Order Artiodactyla

- Odocoileus virginianus borealis* Miller—Northern Virginia Deer

**SPECIES REPORTED PREVIOUSLY
FROM THE AREA;
NOT TAKEN DURING PRESENT SURVEY**

Amphibians

- Cryptobranchus alleganiensis* Daudin—Hellbender (Bishop, 1927; 1941)
Ambystoma jeffersonianum Green—Jefferson Salamander (Bishop, 1927; 1941)
Ambystoma maculatum Shaw—Spotted Salamander (Bishop, 1927; 1941)
Pseudotriton ruber ruber Sonnini—Northern Red Salamander (Bishop, 1927)
Hyla versicolor versicolor LeConte—Eastern Gray Treefrog (Bishop, 1927)

Reptiles

- Stenotherus odoratus* Latreille—Stinkpot (Bishop, 1927)
Clemmys guttata Schneider—Spotted Turtle (Bishop, 1927)
Clemmys insculpta LeConte—Wood Turtle (Bishop, 1927)
Thamnophis sauritus Linnaeus—Ribbon Snake (Bishop, 1927)
Elaphe obsoleta obsoleta Say—Black Rat Snake (Bishop, 1927)

Mammals

- Sorex palustris albibarbis* Cope—White-lipped Water Shrew (Eaton, 1945)
Parascalops breweri Bachman—Hairy-tailed Mole (Knobloch, 1943)
Condylura cristata cristata Linnaeus—Star-nosed Mole (Knobloch, 1943)
Lepus americanus Erxleben—Varying Hare (Knobloch, 1944)
Sylvilagus transitionalis Bangs—New England Cottontail (Knobloch, 1944)
Glaucomys volans volans Linnaeus—Small Eastern Flying Squirrel (Knobloch, 1944)
Glaucomys sabrinus sabrinus Shaw—Northern Flying Squirrel (Knobloch, 1944)
Rattus norvegicus Berkenhout—Norway Rat (Knobloch, 1944)
Mus musculus domesticus Ruddy—House Mouse (Knobloch, 1944)
Urocyon cinereoargenteus cinereoargenteus Schreber—Gray Fox (Knobloch, 1944)
Mustela erminea cicognanii Bonaparte—Bonaparte's Weasel (Knobloch, 1944)
Mustela frenata noveboracensis Emmons—New York Weasel (Knobloch, 1944)
Mustela vison mink Peale and Palisot de Beauvois—Southeastern Mink (Knobloch, 1944)
Lynx rufus rufus Schreber—Bobcat (Knobloch, 1944)

SPECIES TAKEN NOT PREVIOUSLY REPORTED FROM THE AREA

Hemidactylium scutatum Schlegel—Four-toed Salamander
Eumeces anthrocinus anthrocinus Baird—Coal Skink
Trionyx ferox spinifera LeSueur—Eastern Spiny Soft-shell
Pipistrellus subflavus obscurus Miller—Pipistrelle

SPECIES ACCOUNTS OF AMPHIBIANS AND REPTILES

An annotated list of the observed species follows. Remarks of general abundance, as indicated by observations during the field studies, and special observations of interest are included. The list of "associated species" includes other vertebrates which were found within the immediate vicinity of the species under consideration. One kind of invertebrate was found in numbers large enough to warrant mention. Crayfish were extremely abundant in the Allegheny River and all its tributaries. They were the most abundant group observed in these aquatic habitats. Although they are not mentioned in each account, they might well influence the amount of food available for most of the aquatic vertebrates and might even prey upon some of them, especially in the larval stages.

A list of collection sites for all species with details of the habitats and dates of collections is given in table I. The corresponding name or number of each site is used when mentioned subsequently.

MUDPUPPY

This handsome salamander was found in three localities, all near the mouth of some tributary of the Allegheny River—Quaker Run, Wolf Run and Sawmill Run. Eleven nesting adults, presumably females, were found July 10 in Quaker Run in a 200-yard stretch above the railroad bridge crossing. This is the area described as a suitable habitat by Bishop (1927). Eggs were attached to the lower surface of large flat rocks, in water up to two and one-half feet deep. Adults were guarding 10 of the nests. Eggs varied in number from 25 to 150, the usual complement numbering about 100. Eggs were three-fourths inch in diameter, and larvae were in the hind limb bud stage. The same area was examined August 28. One adult was seen; it was under a large flat rock in one foot of water. A few egg membranes were still attached to the nest rocks; no larvae were seen, but the water was extremely turbid due to recent rain.

Nests were also found in Wolf Run (one nest 400 yards upstream from mouth; adult attending about 100 eggs) and Sawmill Run. There, four nests were found 200-300 yards from the mouth of the run. Three of the nests (under large slabs of rocks in six to eight inches of water) were attended by adults. When such a nest site was lifted and the adult

exposed, the mudpuppy made no effort to escape unless disturbance was continued. Instead, it nestled closer to the rock. All movements were slow unless the animal was actually touched continually for several minutes. Then it would swim away very rapidly several yards from the rock. When all was again quiet, it would return slowly but directly to the rock.

Records:

July 10, Quaker Run, above railroad bridge, Wolf Run Road, 11 nests with adults in attendance.

July 11, Wolf Run, 400 yards from mouth in pool in wide area of creek, 1 nest with adult attending.

July 16, Sawmill Run, 4 nests with adults attending, 1 carcass in creek.

Aug. 28, Quaker Run, 1 adult, with swollen vent, under rock in 1½-foot of water about ¼-mile below nesting area.

RED-SPOTTED NEWT; RED EFT

This species was seen more often in the terrestrial stage than as aquatic adults. Adults, however, were common in pools and backwaters along Sawmill Run, State Line Run and Red House Lake. Efts were seen in great abundance August 29 after three rainy days. They were apparently migrating to the water at this time. About 20 large individuals were seen in about 200 yards crossing A.S.P. No. 2 on the northeast side of Red House Lake. Numbers were less concentrated in adjacent areas. On the same day, many were seen crossing Route 17, west of Olean, in a wooded area. Except for this observation, efts were solitary or seen in small numbers. Three large bright ones were encountered around the same stump on the mixed hardwood slope by State Line Road.

Associated species:

Green frog

Records:

July 8, State Line Road, 3 red efts in woods—adults common in pools.

July 10, Quaker Run, Wolf Run Road, 1 red eft in woods.

July 11, Wolf Run, 1 red eft on hemlock slope.

July 16, Sawmill Run, adults common in pools and backwaters of stream.

Aug. 23, State Line Road, red eft in road ditch.

Aug. 29, Red House Lake, red efts abundant crossing highway.

NORTHERN DUSKY SALAMANDER

This is one of the most common salamanders in the area. They are less common, however, than their near relative, the mountain salamander, which was almost ubiquitous. Individuals showed a great deal of variation in color and pattern. Some were very dark with faint mottling, while others were light with pronounced pattern, even in large adults. One large male taken in State Line Run was very similar in appearance to the seal salamander, *Desmognathus phoca*.

Associated species:

Mountain salamander

Two-lined salamander

Spring salamander

Records:

July 8, State Line Run, 1 subadult, 5 adult males taken, 2 resembling *D. phoca*.

July 11, Wolf Run, 2 adults by edge of run.

July 16, Sawmill Run, all sizes common along creek.

July 17, State Line Run, along dry stony run by logging road on north side of road.

July 22, Quaker Run, Blacksnake Mountain by Science Lake, several along run and in draws on slope above lake.

July 29, Bone Run, 7 large adults taken, smaller ones common.

July 30, Bone Run, all sizes abundant, 6 (4½-inch) males, 1 large female taken, others smaller to one-year size.

Aug. 7, Quaker Run, near Friends Indian School, shaded hemlock and shale ravine, 3 large males.

Aug. 25, Bear Springs, several in small stream.

ALLEGHENY MOUNTAIN SALAMANDER

This was the most common salamander observed in the area. It could be found under rocks in almost any damp woods either very near the water or within 100-200 yards of a source of moisture. This does not mean that they were restricted to such a situation, but they were less common at greater distances from water. They were never found in an area which was not wooded or where shade was not abundant. Along the stream banks, they were frequently in company with the two-lined and dusky salamanders, and in drier situations were sometimes taken under the same rock as the red-backed salamander or Wehrle's salamander. The species was abundant along State Line Run and Bone Run where individuals showed much variation in color and pattern. In the park they were even more abundant than on the reservation; this was probably due to more abundant moisture in the dense woods.

Associated species:

Dusky salamander

Two-lined salamander

Red-backed salamander

Wehrle's salamander

Slimy salamander

Pickerel frog

Records:

July 8, State Line Run, common along run and small tributaries.

July 10, Quaker Run, near railroad bridge, 10 adults in a 25-yard transect on wooded slope.

July 11, Wolf Run, 2 adults under rocks at edge of run.

July 16, Sawmill Run, several along draws and creek.

July 17, State Line Road, abundant in bed of dry stony tributary near logging road.

- July 22, Blacksnake Mountain, all sizes abundant, almost every rock or log harbored one or more individuals.
July 28, Bear Cave slope, common under rocks along draw.
July 29, Bone Run, off Little Bone Run Road, all sizes common.
July 30, Bone Run, 5 adults (3 females, 2 males) taken which show much variety of color pattern.
Aug. 6, Quaker Run, McCabe trail, common in woods with red-backed salamander.
Aug. 25, Bear Springs, common along streams.

RED-BACKED SALAMANDER

This species was encountered in the same type of habitat as the mountain salamander, but not in such abundance in most areas. On August 6, two nests of 8-10 eggs, each guarded by the adult, were found under embedded flat rocks in the woods just south of McCabe Trail. This was the only species of salamander seen in the sphagnum Bear Bog in the park.

Associated species:

Mountain salamander
Wehrle's salamander

Records:

- July 8, State Line Run, several by small tributaries.
July 9, Sphagnum Bear Bog, 8 adults, 4 subadults in and under rotten logs and bark, bog wet.
July 10, Quaker Run, near railroad bridge, 7 adults on wooded slope.
July 22, Blacksnake Mountain, common on wooded slope.
July 28, Bear Caves, few adults under rocks on wooded slope.
Aug. 6, Quaker Run, McCabe Trail, 2 nests under rocks in woods.
Aug. 25, Bear Springs, common under rocks and logs.

SLIMY SALAMANDER

This is one of the more handsome salamanders of the area, but it is seldom encountered. Only six individuals were seen during the summer. As the records show, it is not restricted to moist situations.

Associated species:

Red-backed salamander

Records:

- July 11, Elko Mountain, 1 6-inch adult under shale slab on railroad cut, in the sun; 2½-inch subadult under bark of rotten stump on hemlock slope.
July 20, English Creek, 1 subadult under rock in woods.
July 26, Gypsy Trail, under large slab in cabin yard, in the sun.
July 28, Bear Caves slope, adult under rock by moist draw.
July 30, Bone Run, large adult under slab on south-facing wooded slope.

WEHRLE'S SALAMANDER

This is one of the very rare salamanders of New York. Allegany State Park is one of the few areas in which it has been found. It was seen in 1957 at the same site where it was first discovered in the State 30 years ago. Five adults were seen on the slope of Blacksnake Mountain above the powerline cut south of Science Lake. All were under partially embedded large rocks (at least one foot in diameter). The slope was quite dry since there had been little rain recently. They moved very slowly when captured.

Associated species:

Red-backed salamander

Mountain salamander

Record:

July 22, Blacksnake Mountain, 2 adult males (4 $\frac{3}{4}$ -inch, 5-inch) and 3 adult females (3 $\frac{3}{8}$ -inch; 3 $\frac{1}{2}$ -inch; 4 $\frac{1}{4}$ -inch).

FOUR-TOED SALAMANDER

Although this species has never been discovered in the reservation or in the park, it might be expected to occur in Bear Bog and the Fir Tree Swamp, two known sphagnum-covered areas in the park. It was discovered at Keith's Bog, near Steamburg. One adult was taken from under a piece of old tar paper on a dry sunny blueberry slope overlooking the almost dry bog.

Associated species:

Common garter snake

Short-headed garter snake

Ring-necked snake

Red-bellied snake

Record:

July 26, Keith's Bog, 1 adult.

SPRING SALAMANDER

This aquatic species was not observed in large numbers but was seen in widely scattered areas. It was not always in wooded areas. A small larva was taken in an open meadow-bordered section of State Line Run, another in a tiny exposed rocky stream flowing out of an oak-hickory slope at Bradford Junction. They were more common at Bear Springs, a cold spring-fed brook, than anywhere else.

Associated species:

Dusky salamander

Mountain salamander

Two-lined salamander

Records:

July 8, State Line Run, 1 2-inch larva.

July 9, Bradford Junction, 1 2-inch larva.

July 11, Wolf Run, 1 small larva.

- Aug. 4, Quaker Run, McCabe Trail, 2 adults ($4\frac{1}{2}$ -inch, $5\frac{1}{2}$ -inch), 2 larvae ($3\frac{1}{2}$ -inch, $4\frac{1}{2}$ -inch).
Aug. 6, same locality, 1 adult ($5\frac{1}{2}$ -inch), 4 larvae (2-inch, 4-inch).
Aug. 25, Bear Springs, 1 adult (7-inch), transforming larva (4-inch), 6 larvae ($2\frac{3}{4}$ -inch).
Aug. 26, same locality, 3 large larvae.

TWO-LINED SALAMANDER

The only sites where this species was found in abundance were in Sawmill Run, below the bridge near Onoville and in the north fork of Bone Run. Adults of this species are often difficult to find during the summer months, but, if they are present in an area, larvae are easily detected under stones in shallow water. Although more common in shaded areas, this species is not restricted to wooded sites.

Associated species:

Dusky salamander
Mountain salamander
Spring salamander

Records:

- July 8, State Line Run, 1 subadult in transformation, 1 two-year larva.
July 16, Sawmill Run, 7 adults, 10 transforming subadults, and 6 two-year larvae in 25 yards of streambed.
July 23, Meetinghouse Run, near Red House, several two-year larvae under rocks in shallow, partially shaded portions of small stream.
July 29, Bone Run, north fork, off Little Bone Run Road, all sizes from young of the year to large adults in stream and on slope.
July 30, Bone Run, north fork, 6 large adults (3 over 4 inches), 2 recently transformed subadults, in wooded area.
Aug. 25, Bear Springs, 1 adult female.
Aug. 29, Quaker Run, near mouth, 2 large adult females under rocks at edge of creek.

AMERICAN TOAD

These were seen in several localities, and are apparently one of the more common anurans seen during the summer months. Sizes ranged from recently transformed individuals common along streams and ponds to large adults three and one-half inches in body length.

Associated species:

Newt
Leopard frog
Pickerel frog

Records:

- July 8, State Line Run, adult on anthill by stream.
July 9, Bradford Junction, adult under shale slab, exposed on sunny dry slope.
July 10, Quaker Run, Wolf Run Road, adult under rock by creek.
July 16, Sawmill Run, small adults under rocks by stream.

- July 22, Science Lake, 1 recently transformed individual by lake.
Aug. 6, large island in river near Quaker Bridge, adult female ($3\frac{1}{2}$ inches) in grass.
Aug. 7, small clearing on A.S.P. No. 1, adult female ($3\frac{1}{2}$ -inch) in wet grass.
Aug. 13, 14, gravel pit, small recently transformed individuals around edge of water.

NORTHERN SPRING PEEPER

These tiny frogs were seen only once during the summer, but were heard singing (singly, rather than in chorus) at three different sites.

Records:

- July 19, Tunungwant Swamp, recently transformed individuals in large numbers on leaves of weeds and sedges in open sun.
Aug. 13, 14, gravel pit, heard singing in woods in the sunny morning.
Aug. 24, woods by Stoddard Creek 1 mile south of Red House Lake, heard singing at dusk.
Aug. 25, Twin Springs, A.S.P., heard singing at dusk after misty afternoon.

BULLFROG

The only previous record of this frog was from the Tunungwant Swamp (Bishop, 1927). Although seen several times on the reservation, it was never observed in the park during the present study.

Associated species:

American toad
Leopard frog
Green frog

Records:

- July 11, Wolf Run, large adult between rocks under railroad bridge.
July 16, Sawmill Run, 2 large tadpoles with hind legs, in pool near road.
July 23, gaging station, a half-eaten carcass near the water; adult by river.
Aug. 13, 14, gravel pit, by edge of pond.

GREEN FROG

This is the frog most commonly seen in the study area.

Associated species:

Newt
Leopard frog
Bullfrog
Wood frog

Records:

- July 8, State Line Run, transforming tadpoles, in pools by run.
July 16, Sawmill Run, 1 tadpole, hind legs, 1 recently transformed individual.

July 19, Tunungwant Swamp, common along creek: adults and tadpoles.

July 25, Keith's Bog, large adult male in meadow.

July 29, North fork, Bone Run, all sizes abundant along stream and in meadow.

Aug. 9, Balsam Fir Swamp, 1 adult taken in snaptrap by little pool.

Aug. 13, 14, gravel pit, several small adults in muddy road ruts.

WOOD FROG

The wood frog is not often seen during the summer months. Only three adults were seen during the entire study; one of these was taken in a snaptrap.

Associated species:

Newt

Mountain salamander

Dusky salamander

Leopard frog

Records:

July 8, State Line Road, transforming individuals in pools by run.

July 30, Bone Run Road, adult caught in snaptrap in old orchard.

Aug. 4, McCabe Trail, 1 adult in woods.

Aug. 7, Quaker Run rental office, adult in window well.

NORTHERN LEOPARD FROG

Although Bishop (1927) found this to be one of the most common frogs in the area, it was rarely seen during this study.

Associated species:

Dusky salamander

Mountain salamander

Green frog

Wood frog

Pickerel frog

Records:

July 22, Science Lake, 2 small adults by lake.

July 23, Keith's Bog, small adult in little swale.

July 30, Bone Run, 1 adult.

Aug. 14, gravel pit, several adults, both green and brown phase around pond.

PICKEREL FROG

This species was seen in situations similar to those of the closely related leopard frog. Both species seem to be rather rare in the area.

Associated species:

Leopard frog

American toad

Records:

July 22, Science Lake, small transformed individuals by water.

July 29, Bone Run, 1 adult by stream.

Aug. 5, Seneca Trading Post, Quaker Bridge, large adult male in grassy area, recently mowed for hay.

COMMON SNAPPING TURTLE

Bishop (1927) reported this species only from the Tunungwant Valley. In the present study it was located in the Quaker Run area of the park and in the reservation.

Associated species:

Spring peeper

Leopard frog

Green frog

Bullfrog

Records:

July 19, Tunungwant Swamp, in small pool of water in sun. Carapace $4\frac{1}{2}$ inches long.

Aug. 13, gravel pit, algal-covered carapace scales found at edge of water.

Aug. 25, Quaker Run, in rocky run near western edge of park, very aggressive adult; carapace 10 inches long.

MIDLAND PAINTED TURTLE

Although Bishop (1927) stated that this was one of the commonest turtles in the area, it was seen in only two sites during the summer, neither of which is actually in the park.

Associated species:

Soft-shell

American toad

Leopard frog

Green frog

Records:

Aug. 2, Quaker Bridge, 1 subadult sunning on lily pad in garden pool of local resident.

Aug. 13, 14, gravel pit, several adults sunning on beaver house.

Aug. 25, gravel pit, one adult taken from small shallow backwater.

EASTERN SPINY SOFT-SHELL

This turtle had not been previously reported from the area although the county is within the range given by Carr (1952). One specimen was taken as it burrowed into the mud of a backwater of the Allegheny River near the mouth of Red House Brook. Harry Kilburn, manager of the Red House Lake concession, reported that the gravel pit near Red House was used as a source of soft-shelled turtles by the Indians.

Upon his suggestion, we tried catching them there, but with no success. One line was stolen and the other had 10 of 12 baited No. 4 fishhooks bitten from it.

Associated species:

Bullfrog
Leopard frog
Green frog
American toad
Painted turtle

Records:

July 23, Allegheny River, backwater about 1 mile west of Red House,
1 adult; carapace 7 inches long.

Aug. 13, gravel pit, small individual seen sunning on beaver house.

COAL SKINK

Although this species is fairly common in a few areas of central New York and in Pennsylvania, it had not previously been reported from the Alleghany State Park region.

One individual was seen crossing a small logging road off State Line Road July 17. The spot was in the sun at 11 a.m. when the observation was made. The lizard escaped capture, but on a hot sunny afternoon, August 23, a concerted effort was made to collect a specimen. Three adults were uncovered within 2 yards of each other, a spot about 10 yards from where the first observation was made. They were under small shale slabs in a tiny open brushy area by the edge of the woods on the road cut. Brush from a felled tree had accumulated and begun to rot, creating a porous soil of sawdust and humus. One individual released its tail when captured.

Records:

July 17, State Line Road, 1 seen in woods by road.

Aug. 23, same site, 3 adults.

NORTHERN WATER SNAKE

Only one water snake was taken during the summer. It was coiled under a flat stone in the shallow Meetinghouse Run.

Associated species:

Two-lined salamander
Johnny darters

Records:

July 23, Meetinghouse Run, 1 young adult, color pattern pronounced.

July 23, gaging station, Allegheny River, 1 adult fell into water from sunning on debris.

July 24, Allegheny River, 2 adults seen swimming into water when frightened from riverbank.

Aug. 23, Red House Lake, 1 large adult frightened into water from sunning in rushes.

NORTHERN BROWN SNAKE

Only one brown snake was seen during the entire study. It was under a small stone on a roadbank in company with red-bellied snakes.

Associated species:

Red-bellied snake

Record:

July 6, Bone Run Road, 1 adult.

RED-BELLIED SNAKE

This snake and the short-headed garter snake were the two snakes most commonly seen in the area. Individuals were always taken from under rocks where they remained quietly in a coil, even after being exposed. Not until they were touched did they make an effort to escape.

Associated species:

Common garter snake

Short-headed garter snake

Ring-necked snake

Brown snake

Records:

July 6, Bone Run Road, several adults under rocks on roadbank, both brown and gray color phases seen.

July 10, Quaker Run, near Wolf Run Road, 1 adult under rock near dump, in shade.

July 11, Wolf Run, near mouth, 2 adults, one under shale slab by railroad track, other under rock by road.

July 25, Keith's Bog, 1 adult under debris and tar paper on dry slope above bog—under same pile of paper as a common garter snake.

Aug. 16, gaging station, 1 adult under wooden slab in open field.

Aug. 22, Randolph Fish Hatchery, 1 adult under rock by fish pools.

Aug. 27, Gypsy Trail, 1 adult under rock by road.

SHORT-HEADED GARTER SNAKE

These snakes were seen in greater abundance than any others. Since they have the habit of sunning or lying exposed on the grass more often than other species, perhaps they are detected more readily. This may give a somewhat false impression of large numbers. Their tendency to congregate in one area might also support this. They were found in moist grassy areas as well as on dry rocky slopes.

One site was observed to be heavily populated with short-headed garter snakes: the brushy path leading to the gaging station by the river at Red House. A thicket on each side provided adequate cover, and the freshly mown grass and weeds by the path left an exposed strip for sunning. Each time an observer walked down the path, the snakes (one about every two yards) would quietly slide back to cover from the sun along the path. Two hours were devoted to watching these

snakes. About 10 minutes after being disturbed, they would come out of hiding and return to the sun. Five large adults were captured by waiting quietly in the center of the path. At least four more were seen which were not taken. Two were watched crawling onto a small mound of grass where they coiled slowly about each other and lay sunning for about 15 minutes until they were captured. They were very gentle, never attempting to strike or bite. Instead they coiled gently around one's fingers or hand. The second time the gaging station was visited, the snakes seemed to be as numerous as before.

One individual was found coiled under a rock with a common garter snake, and another was found under the same board as a red-bellied snake.

Associated species:

Common garter snake
Ring-necked snake
Red-bellied snake

Records:

July 23, gaging station by river, 5 adults taken, 4 more observed.
July 25, Keith's Bog, 1 adult female under old stump on grassy kame overlooking Red Pond (gravid with 9 young, nearly ready to be born), 6 under debris on slope overlooking Keith's Bog.
July 28, Quaker Run camping area, 1 adult, d.o.r.
Aug. 14, gaging station, several seen along path.
Aug. 16, Red House, near gaging station, 1 adult under slab in field.
Aug. 20, Hotchkiss Hollow, 1 adult in cornfield.
Aug. 23, Sawmill Run, 1 adult by roadside.

EASTERN GARTER SNAKE

Although seen several times throughout the summer, this species was not seen in as large numbers as the short-headed garter snake. When disturbed in an exposed position, the snake seemed to perform its aggressive display of puffing and striking, an attitude not observed if the snake were found under cover.

Associated species:

Short-headed garter snake
Red-bellied snake
Ring-necked snake

Records:

July 9, Bradford Junction, 1 adult crawling in leaves on dry, sunny hardwood slope.
July 10, Quaker Run, Wolf Run Road, 1 adult under rock in rut of woods road.
July 17, Quaker Run camping area, 1 adult, d.o.r.
July 25, Keith's Bog, 1 adult under debris at base of blueberry bush on slope, 1 subadult in recently mown field near Blood Road struck and puffed when approached.
Aug. 8, Balsam Fir Swamp, 1 large adult exposed in field displayed viciously when approached, flattening entire body and striking.

Aug 17, Brown's Hollow ridge, 1 adult crawling on sunny leaves below boulder of rattlesnake den.

Aug. 22, Randolph Fish Hatchery, 1 adult taken near fish tanks.

NORTHERN SMOOTH GREEN SNAKE

This snake was observed only once during the summer. Its protective coloration might prevent its having been observed more often.

Associated species:

Ring-necked snake

Red-bellied snake

Common garter snake

Record:

July 17, A.S.P. No. 1, 1 adult under shale on steep sunny roadbank.

NORTHERN RING-NECKED SNAKE

Less common than the red-bellied snake, but in the same habitat, this species was found frequently on sunny banks under rocks.

Associated species:

Red-bellied snake

Common garter snake

Smooth green snake

Short-headed garter snake

Records:

July 10, Quaker Run, near railroad bridge, under rocks near shaded dump.

July 11, Wolf Run, along railroad tracks, 3 adults, 2 under same slab, another about 10 yards away.

July 17, A.S.P. No. 1, under shale slab on steep sunny road cut.

EASTERN MILK SNAKE

Only one specimen was seen during the summer. It was sunning on the cinders by the railroad track and made no effort to escape when captured.

Record:

July 23, Meetinghouse Run, Route 17, by railroad track.

TIMBER RATTLESNAKE

Although the Allegany Park region is one of the few remaining localities in New York State where the timber rattlesnake may be found, it seems to be getting scarce even there. The species is seen so rarely that many of the campers coming to the park never know of its existence. Most of the "snake stories" that the natives tell of seeing rattlers in the park are from years ago; few of the people have seen a live rattler in recent years, except near the den sites.

Alden Wright, a youth who lives on Wolf Run Road near Brown's Hollow, took the investigators to the rattler den on the ridge which

his family has known about for years. He said that even there, where he never failed to find rattlers, they were getting very scarce. He reported having seen only two during the summer in early August. One adult was killed on Brown's Hollow road by the workers while widening the road. Another large adult was taken by Alden from a small ditch near the abandoned School No. 3.

The snake den examined was an accumulation of scattered large blocks of quartz conglomerate in a mixed deciduous forest. The second growth of maple, oak, hickory and serviceberry permitted abundant sunlight to fall on the forest floor. Patches of earth on the boulders afford a favorable site for the growth of moss, ferns, small trees and shrubs on the larger rocks. Rough ledges and deep crevices on the sides and under the boulders provided adequate hiding places for the snakes.

The snake found was a pregnant female, 46 inches long, with 11 rattles. It was coiled at the base of a clump of serviceberry trunks, shaded and well hidden from sight, on one corner of a 15-foot by 15-foot boulder, about 4 feet from the ground. The snake did not rattle or attempt to escape as a noose was slipped around its neck. It did rattle when stretched on the rock. The snake was kept in captivity until September 25 when it gave birth to 12 young. One was born dead. A complete description of the litter is being published (Stewart, *et al.*, 1960).

Record:

August 17, Brown's Hollow ridge, 1 pregnant female.

SMALL MAMMALS

Since no detailed study of small mammals of the Allegany region in New York State has been made, a special effort was made to obtain exact data on distribution, population density and variation within populations for the area. Knobloch (1943, 1944) included small mammals in his list of Allegany Park mammals, but included little specific data about them.

Table II, a resumé of trapping done and results of the trapping efforts, indicates species trapped on each site. Sex, weight, measurements and breeding condition of each animal captured were recorded. Extremes and means for these data are given in table III. Actual data sheets have been deposited with the curator of zoology, New York State Museum, where they are available for reference to anyone desiring further information.

Table II gives some indication of the relative numbers of animals captured at various sites. It is understood that these represent only those animals which are taken by traditional trapping techniques. For those species which are trap-shy (such as *Synaptomys cooperi* and *Sorex*) numbers taken are not necessarily an indication of relative numbers present. Other species may well be present which were never seen (such as *Cryptotis parva*). *Sorex palustris* has been taken from Stoddard Creek near Red House (Eaton, 1945). Traps were set at close intervals along the banks and in the creek at the same site, but no

shrews were taken. Raccoons were a serious hazard to trapping in the area; of 150 traps set, 140 were sprung by the raccoons which seemed to enjoy pushing them into the water and playing with them.

Numbers of species trapped in any area must be considered in view of numbers of trap nights in that area. Even so, a distinct difference was noted in the relative abundance of species, or of numbers of a single species, between different collection sites. The largest numbers of animals trapped were in the wooded areas of the park or reservation. It is of interest to note that the next greatest number of species, as well as the most dense population found, was on the large wooded islands in the Allegheny River. These will be discussed separately. Numbers were noticeably low in the open field habitat (site No. 10), where cover was light and the field very dry, and in the recently burned flats (site No. 4). Although there was plenty of cover in the flats, there evidently had not been time for animals to move into the area; food might also be a limiting factor. Another site with marked paucity of life was the small balsam fir stand (No. 27). It seemed to be a natural cover in the center of an open grassy pasture; moisture was abundant and a variety of plants would seem to provide adequate food. The constant disturbance by a herd of cows might have some effect on the small mammals.

Small mammals trapped, in order of abundance, were as follows: *Blarina brevicauda*, *Peromyscus leucopus*, *Microtus pennsylvanicus*, *Napaeozapus insignis*, *Peromyscus maniculatus*, *Zapus hudsonius*, *Clethrionomys gapperi*, *Sorex cinereus*, *Sorex fumeus* and *Synaptomys cooperi*. From the presence of *Blarina brevicauda* and *Peromyscus leucopus* in the majority of sites, it seems that these two species have the widest local distribution.

The lemming mouse is certainly much more common than trapping results indicate. It seemed to inhabit small grassy clearings within wooded areas. Evidence of its presence, piles of matchstick size grass-cuttings and green droppings, were found in two areas where the animals were not taken. Even in the areas where they were trapped, traps were left down several nights before a catch was made. They had been previously trapped in the park by Dr. W. J. Hamilton, Jr. (1941).

Botfly larvae (*Cuterebra* sp.) were prevalent in species of *Peromyscus*. Twelve percent of both *P. leucopus* and *P. maniculatus* were infected, the incidence being equally divided between males and females. These were found only in August. Other species infected were *Microtus pennsylvanicus*, *Napaeozapus insignis*, and *Sciurus* sp. Of the 14 infections in *P. leucopus* encountered, 12 occurred in animals from the islands where 30 percent of the animals taken were infected. Forty percent of the *P. maniculatus* from the islands were infected. No infections were found in this species from other sites. The reason for this difference is not known; perhaps it was a result of lessened resistance due to overpopulation, or possibly the islands are especially suited to the breeding of botflies.

INSULAR POPULATIONS

There are several large islands in the river in the Red House-Quaker Bridge area. The largest is 40 to 50 acres in extent. They are wooded, the large trees being principally silver maple, American elm, sycamore, red maple and black willow. At the time of this study, there was usually a lower growth of shrubby willow around the edge of the islands. Open patches afforded a lush growth of sedges, composites, wild grape, nettles, touch-me-not and violets. Ostrich ferns, often shoulder high, were present in large areas in partial shade from the large trees. Narrow strips of pebble beach surrounded parts of the islands during the summer when the water was low. The islands were accessible from the mainland by wading. The water was less than a foot deep in some stretches during August. Small waterholes in various stages of desiccation were present on the islands.

Results obtained from island trapping were markedly different from other localities. The two islands near Erie Station yielded in one night (40 trap nights) a 60 percent catch. The island immediately below Quaker Bridge yielded in two nights (394 trap nights) a 21 percent catch. The reason for the extremely high populations is not known. Whether it was relative freedom from predation by shrews, or abundance of food or some other factor was not determined. Measurements of animals taken from the island did not differ from those from the mainland. Weights were slightly greater. The islands are flooded every spring. Piles of debris left from high water, and the verdant plant growth provided abundant cover. Fruits and seeds seemed to be abundant. A field mouse was observed feeding on *Viola sororia*, which was present in large patches.

Larger mammals are present on the islands. Deer and raccoon tracks were common, and one opossum was taken from the Quaker Bridge island. Red squirrels were trapped, and a mink was seen carrying off a victim of a snaptrap.

Peromyscus leucopus, *Microtus pennsylvanicus* and *Zapus hudsonicus* were the most abundant species trapped. The marked scarcity of shrews might account for the large number of mice. Three *Blarina brevicauda* and one *Sorex cinereus* were taken. Elsewhere *B. brevicauda* was taken in greater numbers than any other species. This apparent scarcity of shrews might be due to the annual flooding which would destroy many more fossorial forms than mice, which can climb easily.

A detailed study of the seasonal and annual variation in the populations of small mammals on the islands would provide some much needed information about the effects of flooding on small mammals.

LARGE MAMMALS

Since a reliable census of large mammals is extremely difficult, no effort was made to evaluate exactly the population size of these forms in the short time available. However, notes were taken on species

observed and their signs. Much of the information obtained by Richmond and Rosland (1949) in the adjacent region of Pennsylvania might be applicable to this area, especially that part concerning Warren County which lies just south of Allegany State Park and the Indian reservation.

BIG GAME

Virginia deer and black bear are the only big game forms on the reservation. Deer are common in the reservation as well as in the adjacent park where they abound. Open fields and meadows, surrounded by wooded sections, provide excellent grazing, browse and cover. Tracks were seen in almost every site examined. Paths through the grass and woods were seen along Sawmill Run, Bone Run, Quaker Run near Wolf Run Road, on the islands, by the gravel pit, in the flats near Bradford Junction and in the Tunungwant Swamp. A doe and two fawns were seen on State Line Road July 17. Deer were frequently seen in the park, either alone, with a fawn or in groups up to five. They were seen more frequently in the area near Red House Lake than anywhere else. They were seen during the day as well as early morning and evening and after dark. The park deer were studied previously by Shadle and Stalken (1942).

Although no bears were seen outside the park, a tree clawed by bears and a wallow were found near State Line Road. One of the Indians reported having seen a bear in the river near Quaker Bridge early in July. The abandoned land and forested hills in the reservation and to the west of it are well suited to bears. Patches of wild strawberries, blueberries and blackberries abound. Ant colonies are common. Bears seem to be more common in the park where they are frequently seen along the highways and feeding at the park dumps. A bear with four cubs was seen during the summer at the park dump. Three of these and one other adult were trapped by Hugh Black who was studying the bears in the park. He reported that numbers were lower this year than in previous years, but that an exact estimate of the population could not be made; 15-20 bears are taken each year from the park area.

UPLAND GAME

Cottontails, hares, gray squirrel, gray and red fox, raccoon, opossum and woodchuck are the upland game species in the reservation. Much overgrown farmland and woodland provides abundant cover for these forms.

Perhaps the most abundant species in the reservation, the park and adjacent farmland is the raccoon. Its marks—tracks and scats—were ubiquitous along the edge of the river, streams, draws and mud puddles. Farmers to the west of the reservation complained of coon damage to crops, and sometimes have wholesale hunts to reduce the number of animals which have become serious pests. On the other hand, raccoons are encouraged in the park by campers and garbage. Almost any night along A.S.P. No. 1 between Red House and the Quaker Bridge camping area, 15 to 25 raccoons, including several mothers with 2 to 4 young could be counted. They made nightly tours from cabin to cabin

to raid garbage cans. Tracks were abundant on the islands as well as on the mainland.

Woodchucks were abundant both in the open bottom lands and the higher wooded slopes and riverbanks. Their population must reach near capacity for the area. They were seen frequently feeding along the roadbanks and in the fields. Their holes were found in most collection sites. Opossum were seen dead on the road, except for one specimen taken in a trap on the Quaker Bridge island.

Although no gray squirrels were seen on the reservation during the summer, they were seen frequently in the park, just on the edge of the reservation, and in the Red House camping area. About 30 percent of those seen were black, or melanistic individuals. The "squirrel niche" seems to be occupied to a much greater extent by the red squirrels which were seen along the river, in the higher mixed forests and frequently in the park.

Red and gray foxes are present on the reservation and in greater numbers in the park. No gray foxes were seen during the summer, although previous reports (Knobloch, 1944) and accounts of the residents indicated their presence. Nine observations of red foxes were made in the park during the summer.

Relatively few cottontails were seen during the summer. It was impossible to tell by sight whether they were *Sylvilagus floridanus* or *S. transitionalis*. One *S. floridanus* was found dead on the road near the Friends Indian School. Individuals were flushed on Wolf Run Road near Quaker Run, and near the old church at the junction of Routes 280 and 17. The recent status of the species in the area is not known. Several species of rabbits have been released in the area in the past. The Indians trap and hunt rabbits during the winter. They reported the presence of the varying hare on the higher ridges. None were seen during the summer.

FUR-BEARING MAMMALS

Fur-bearers on the reservation include beaver, muskrat, raccoon, opossum, red and gray fox, skunk, mink, and various weasels. The raccoon, opossum and foxes were discussed in the previous section.

From reports by local residents and from the Conservation Department, little trapping is being done on the reservation. Fur prices are low, and most of the Indians are occupied with jobs outside the reservation which provide adequate livelihood without the hunting and trapping.

Beavers did not appear to be common on the reservation although several colonies were established in the park and on the streams feeding into the river from outside the reservation (Pierce Run, Bone Run). A colony was present in the gravel pit near Red House and in Quaker Run near the western edge of the park. The park beavers were quite tame (Bay State Road, Frances Brook Road) and worked in spite of numerous observers. Aspen and willow were abundant in many areas so that food probably was not a limiting factor in their spread. Previous investigators made detailed studies of the park beavers (Shadle and Austin, 1939; Shadle *et al.*, 1943). The Conservation Department had only one

record of a beaver taken from the reservation in 1957, that one coming from the Township of Salamanca.

Muskrats seemed to be the most abundant fur bearer in the reservation. Their well-used holes were abundant along the riverbanks, small backwaters and along streambanks where there were deeper pools. Since banks were soft and open bodies of still water were not abundant, the streambank homes were utilized almost entirely rather than building open water houses. Houses were seen only in the Tunungwant Swamp. One muskrat was seen feeding at the head of Science Lake; five were frightened from the edge of the gravel pit where they were feeding. Scats were found often on rocks and logs near the edge of the river and streams.

Although only one mink (Quaker Bridge Island) and no weasels were seen during the summer, they are present in fair abundance according to previous investigations (Knobloch, 1944). Some mink trapping is done, but not nearly so much as in the past.

Several skunks were seen dead on the road during the summer; four individuals were seen along the road and trails in the Quaker Run camping area, and two were seen feeding along the roadside on Route 17 near Red House.

MISCELLANEOUS FORMS

These animals include the porcupine, red squirrel, chipmunk and bats. Although the red squirrel and chipmunk appear in the trapping table of small mammals, those taken in traps do not represent an indication of numbers in the area.

The porcupine is seen on the reservation, but seems to occur more frequently in the park. There it is often caught in the campsites chewing on equipment. Its numbers are not yet to a point of requiring control measures by the Park Commission. Two records were taken from the reservation during the summer. One large adult was seen by the road between Steamburg and Quaker Bridge on the night of July 19. A carcass, evidently a train casualty, was found on the tracks at Wolf Run. Five were seen in the park during the summer; all were observed either in the late evening or at night.

Both the red squirrel and the chipmunk are common in the area, particularly in the park. The chipmunks are the more numerous, existing in large numbers in the park, especially where there are many rocks to afford shelter.

Small bats were seen in the evenings flying over beaver ponds and in clearings in the park, or flying through the cabin porches. A few used the largest crevices at Bear Caves for sleeping places but no more than three were seen there at any one time. On July 28, one adult male *Myotis lucifugus* and one adult male *Pipistrellus subflavus* were taken from Bear Caves during the day. One *Myotis lucifugus* was taken July 20, when it flew onto the porch of an old abandoned house near the outdoor theater by the Tunungwant Swamp.

POSSIBLE EFFECTS OF FLOODING

The nature of the topography and the distribution of mixed vegetation afford many varied habitats for numerous faunal types. Clearings interspersed with woodlots and bordered by brush or shrubs, an abundance of small streams and a meandering shallow river with small bayous characterize the area. These provide food, cover and water for the variety of animals and plants present. If the river valley is flooded, this would eliminate those habitats associated immediately with the river but would create a deep, cold water reservoir, a situation which is now absent from the region. It is difficult to estimate the effects of flooding on the flora and fauna of the area. Much depends upon the depth of the water and the degree of fluctuation of the water level. The time of year that flooding occurs is an extremely important factor. If the water rises in the spring and summer, when many animals are reproducing, and young are still in nests (especially ground-nesting birds and mammals), or are too weak to escape, destruction to wildlife will be great. Very early spring before most forms are nesting, or late summer before chipmunks, jumping mice, woodchucks, reptiles and amphibians are hibernating, would be the best time for the change to occur. If flooding occurs at such time, most animals could move to higher ground to establish territories. This, however, could create serious difficulties with those species where population pressure is already high. Deer, for example, which already exist in high numbers in outlying areas, might suffer from lack of food due to overcrowded conditions. This might well be the case with small mammals, such as deer mice, field mice, jumping mice and shrews, which serve as food supply for larger forms.

Two species have been found in the area of possible impoundment which were not found at higher elevations in the region under discussion. These are the hellbender and the coal skink, both species with a limited distribution in the State. Excepting these, other species exist in numbers large enough in surrounding areas not to suffer extermination from the region.

With the exception of the river and its immediate environs, there seems to be no significant difference in types of habitats which occur in the reservation and those in adjacent areas. However, such a drastic change as flooding an entire river valley must necessarily have many imperceptible and far-reaching, little understood effects on an entire area.

Certain of the natural habitats present will be destroyed. Aquatic species adapted to swift, shallow water or shallow quiet backwaters will be affected. A deep, cold water habitat, probably with a fluctuating water level, will be created suddenly. Annual changes in water level and silt deposition will create mudflats, advantageous to few forms, and will thereby alter the vegetation between high and low water levels as well as changing the face of the marginal vegetation, and thence the fauna. If an effort is made to create a variety of habitats, such as quiet shallow backwaters (particularly for breeding amphibians), the total impact

of the change might not be so drastic. Careful control of the water level to prevent a great amount of fluctuation would also be a help.

The river bottom lands provide foraging areas for many forms—snakes, frogs and toads, mice, moles and shrews, mustelids, rabbits, foxes, woodchucks, raccoons, opossum, as well as many deer. The flooding of such a large amount of their natural territory could affect each species as well as its predators. Beaver and muskrat might be forced out of the reservation entirely but they could probably survive in some of the smaller streams of the higher coves above a changing water level which prevents the establishment of permanent homes.

Another area to be considered, although it does not lie in New York State, is the river below the dam. It is the site that can be affected most seriously by frequent flushings of cold water from the reservoir. The result can be a biological wasteland since few forms can tolerate, especially in early developmental stages, such a drastic change in water temperature and depth. This would influence particularly various stream fishes present as well as their food supply.

SUGGESTION FOR FURTHER STUDY

If flooding of the valley is to occur, all previous knowledge of the area should be put to use and a serious and extensive study made of the changes produced by flooding. Very little is known of the actual effects of flooding of a large area since few followup studies have been conducted in inundated regions. If such a study could be made, it would be a great contribution to biological knowledge. It is realized that every such instance is different since conditions in each area are different, but a study of one example would eliminate some of the guessing which takes place every time the building of such a reservoir is considered. The value of the reservoir and the expense of building it could then be weighed more carefully against the effects it might have on the vegetation and animal life.

TABLES

TABLE I
Collection Sites in the Allegany Indian Reservation and Adjacent Areas

AREA	QUAD-RANGLE	HABITAT DESCRIPTION	APPROX. ELEV., FT.	EXPOSURE	NO. COLL.	DATE
1. State Line Run, State Line Road	Randolph	A. Banks of State Line Run, $1\frac{1}{4}$ mi. W. of Allegheny River; open meadow, abandoned orchard, sedges and willows rank by streambank B. Moist hemlock-beech-maple woods, S. bank of run, $\frac{3}{4}$ mi. W. of river; heavy shade and leaf mold C. Beech-maple-oak-hickory slope, second growth, few fallen logs, $\frac{5}{8}$ mi. W. of river D. Small clearings by logging road fording run; sedges, grass, <i>Rubus</i> , bracken bordering beech-maple-birch-hemlock-cherry of river E. Recently logged woods, N. side State Line Road, $\frac{5}{8}$ mi. W. of river	1,340 1,320 1,300-1,360 1,290 1,290	open dense shade southern open shade partial shade	1 2 1 2 3	July 8 July 8, 17 July 8 July 8, 17 July 8, 17, Aug. 23
2. Sawmill Run, E. of Onoville	Randolph	Creek bottom and flats from road to river ($\frac{1}{4}$ mi.); bottom land, much with cover of skunk cabbage, <i>Impatiens</i> , nettles; scattered maple-beech-blue beech-elm-hawthorn	1,280	partial shade	3	July 16, 17, Aug. 23
3. North Branch, Bone Run	Jamestown	A. Open meadow of sedges, composites by beech-maple woods; $2\frac{1}{4}$ mi. W. Bone Run Road B. Abandoned orchard; apple, sumac, aspen, hawthorn by hickory, sugar maple woods; 3.2 mi. N. W. from Bone Run Road C. Beech-maple-hemlock woods $1\frac{1}{4}$ mi. N. of Bone Run Road; both sides of road, S.-facing slope, creek bottom	1,460 1,540 1,440	open, N.—facing slope open, N. E.—facing slope shade	1 3 2	July 29 July 29, 30, 31 July 6, 30
4. Recently-burned flats by Route 346 to Onoville	Randolph	Dominated by scrub oak, bracken fern; burned 1 yr. previous to collections; $\frac{3}{4}$ mi. S. E. of Hotchkiss Hollow School	1,360	open, partial shade	1	July 31
5. Wolf Run, Allegheny River and Banks	Randolph	Old field, shaded rocky run, beech-maple-hemlock slope of Elk Mt.; talus slope of railroad cut; river bottom on bank opposite mouth of Wolf Run	1,300-1,327	varied	6	July 11, 12, 17, Aug. 7, 24, 28
6. Quaker Run, at railroad bridge crossing	Randolph	Wide run (15-20 yds.) 1-3 ft. deep; bordered by silver maple, elm, ash, poplar, <i>Rubus</i> , which merge into beech-maple-birch covered hillside; $\frac{1}{2}$ mi. E. of Allegheny River	1,315	E.—facing slope	3	July 10, 11, Aug. 28

TABLE I—Continued

Collection Sites in the Allegany Indian Reservation and Adjacent Areas

AREA	QUAD-RANGLE	HABITAT DESCRIPTION	APPROX. ELEV., FT.	EXPOSURE	NO. COLL.	DATE
7. Large island S. of Quaker Bridge	Randolph	Pebble beach, willow thickets at edge; sedges, composite among large silver maple, elm, sycamore; $\frac{1}{2}$ mi. S. of Quaker Bridge	1,310	partial shade	4	Aug. 1-4
8. Cold Spring Creek	Randolph	Dry run partially shaded by weeds and shrubby bank; oak-hickory-birch-maple woods; N. of railroad track, $1\frac{1}{4}$ mi. E. of Steamburg	1,367	partial shade	1	Aug. 20
9. 2 large islands, Allegheny River near Erie Station	Randolph	Similar to island previously described	1,320-1,330	partial shade	2	July 23, 24
10. Junction Routes 17, 280	Randolph	Abandoned open field of asters, goldenrod, red top, panic grass; <i>Vaccinium</i> , <i>Rubus</i> , bracken, willow and sassafras bordered by sumac and poplar; by old church	1,350	open	4	Aug. 19-22
11. Old Gravel Pit off Route 17, near Red House	Randolph	Water about $\frac{1}{4}$ mi. x 50 yds.; wooded on S. side, meadow on N. side with sedges, rushes, willow, <i>Cornus amomum</i> bordering water; heavy algal growth; marshy at E. end; $1\frac{1}{4}$ mi. W. of Red House about $\frac{3}{4}$ mi. N. of river	1,340	open	3	Aug. 13, 14, 20
12. Meetinghouse Run	Randolph	Gravel banks of railroad, rocky stream shaded by alder thickets surrounded by abandoned fields and orchard, $\frac{3}{4}$ mi. W. of Red House N. of Rte. 17	1,350	open shade	1	July 23
13. Red House, area by gaging station, Allegheny River	Randolph	Wooded shrubby area by river and abandoned house; old field and orchard; goldenrod, sumac, wild cherry, grape, poplar	1,350	partial shade	4	July 23, Aug. 14-16
14. Bradford Junction, intersection Routes 17 and 219	Salamanca	Dry oak-hickory hillside N. of Rte. 17; swampy river bottom flats—elm, maple and lush herbaceous growth	1,500-1,700	S.—facing slope	1	July 9
15. Tunungwant Swamp, Limestone	Salamanca	Open marshy meadow of sedges, rushes, emergent aquatics; thickets of alder, dogwood, <i>Viburnum</i> , hawthorn, rose	1,400	open	2	July 19, Aug. 12
16. Sphagnum Bog, (Bear Bog), A. S. P.	Salamanca	Wooded sphagnum swamp; beech-maple-hemlock-magnolia-witch hazel; heavy leaf mold and humus; $\frac{1}{6}$ mi. N. of State line, 200 yds. W. of Bradford road	2,170	shaded	3	July 9, Aug. 1, 2

TABLE I—Continued
Collection Sites in the Allegany Indian Reservation and Adjacent Areas

AREA	QUAD-RANGLE	HABITAT DESCRIPTION	APPROX. ELEV., FT.	EXPOSURE	NO. COLL.	DATE
17. Blacksnake Mt., Science Lake, A. S. P.	Randolph	Open area surrounding Science Lake, maple-birch woods on level with lake and slope of mountain immediately above and E. of Science Lake	1,860-2,000	shade, open, northern	1	July 22
18. Bear Caves, A. S. P.	Randolph	Open beech-birch-maple woods surrounding large shelf of Salamanca conglomerate outcrop, Quaker Run area	1,650	S.—facing; shade	4	July 28, 30, 31, Aug. 25
19. Quaker Run at McCabe Trail A. S. P.	Randolph	Damp beech-maple-cherry-hemlock woods with open floor, creek running all summer, $\frac{3}{4}$ mi. E. of Quaker Run rental office	1,500	dense shade	1	Aug. 6
20. Coon Run, at end of Gypsy Trail A. S. P.	Randolph	Woods as above, small grassy clearings near trail, rapid rocky stream with many moss-covered boulders in and along stream; Quaker Run camping area, under observation entire time since it was adjacent to living quarters	1,550	shade	10	July 21, Aug. 15-17, 21-26
21. English-Stoddard Road (A. S. P. No. 1)	Randolph	Shale bank of road cut in open sun most of day; scattered vegetation of <i>Rubus</i> , <i>Lycopodium</i> , grasses and sedges; beech-maple woods on each side of road; 3 mi. N. of Quaker Run rental office	2,050	S. W.—facing slope	1	July 17
22. Stoddard Creek and tributary off A. S. P. No. 1	Randolph	Open woods of beech-maple-hemlock-cherry; tributary largely dried except for small pools, but creekbbed moist; from A. S. P. No. 1 to Stoddard Creek and about 200 yds. along creek	1,700-1,840	shade, W.—facing slope	2	Aug. 7, 8
23. Bear Springs, off A. S. P. No. 1	Randolph	Maple-beech-hemlock woods surrounding small clearing of abandoned campsite centered around springs and rocky streams, $2\frac{1}{4}$ mi. N. of Quaker Run rental office	1,920	open, shade	2	Aug. 25, 26
24. A. S. P. No. 1, 2.2 mi. N. of Quaker Run rental office	Randolph	Small grassy clearing, wet, about $\frac{1}{2}$ acre; <i>Salidago</i> , <i>Scirpus</i> , <i>Juncus</i> , <i>Typha</i> ; on west side of highway	1,800	open	5	Aug. 7, 8, 15-17
25. Stoddard Creek near Red House camping area	Salamanca	Several sites along creek, partially in small open meadow surrounded by pine woods; beech maple woods at base of E.—facing slope; $\frac{3}{4}$ mi. S. of Red House Lake, near A. S. P. No. 1	1,520	varied	4	Aug. 21-24
26. A. S. P. No. 1, hillside E. of highway	Salamanca	Planted stand of red, Scotch, and white pine on slope with small clearings of <i>Aster</i> , <i>Rubus</i> , <i>Asclepias</i> ; $\frac{3}{4}$ mi. S. of Red House Lake	1,500-1,600	W.—facing	3	Aug. 22-24

TABLE I—Concluded

Collection Sites in the Allegany Indian Reservation and Adjacent Areas

AREA	QUAD-RANGLE	HABITAT DESCRIPTION	APPROX. ELEV., FT.	EXPOSURE	NO. COLL.	DATE
27. Balsam Fir Swamp at edge of A. S. P.	Randolph	Small isolated stand of balsam fir, white pine, hemlock, yellow birch, red maple, willow, deciduous holly; sphagnum, but almost dry; <i>Juncus</i> and <i>Scirpus</i> in marshy areas surrounding trees; north of Route 382, 1 mi. E. of Red House	1,375	shade, open	2	Aug. 9, 10
28. Brown's Hollow Ridge, N. W. of Brown's Hollow 2 mi. S. of Elko	Randolph	Oak-hickory-birch-cherry- <i>Amelanchier</i> -magnolia dry woods at top of ridge; outcrop of conglomerate forming large boulders, many covered with leaf mold, moss and shrubs; deep crevices between rocks	2,200	open shade	1	Aug. 17
29. Quaker Run, at crossing of A. S. P. No. 3 and 1 mi. E.	Randolph	Mixed maple-beech-hemlock-birch woods merging with predominately oak-hickory woods on slopes	1,340	shade	1	Aug. 25
30. Keith's Bog and Red Pond near Steamburg	Randolph	Sphagnum bog and pond surrounded by black spruce, white pine, <i>Vaccinium</i> , <i>Spiraea</i> , <i>Pyrus melanocarpa</i> , <i>Rhus vernix</i> , <i>Scirpus</i> , <i>Juncus</i> , <i>Carex</i> ; kettle surrounded by grassy slopes; 1 mi. N. E. of Price Corners, $\frac{1}{2}$ mi. N. of Blood Road.	1,410-1,450	open	1	July 25
31. Randolph Fish Hatchery	Randolph	Shrubs and grass lawns	1,300	open	1	Aug. 27

TABLE II
Small Mammal Populations as Indicated by Trapping Results in Various Localities

COLLECTION SITE	NUMBERS TRAPPED AT EACH SITE															TRAP NIGHTS
	<i>SOREX CINEREUS</i>	<i>SOREX FUMEUS</i>	<i>BLARINA BREVICAUDA</i>	<i>TAMIAS STRIATUS</i>	<i>TAMIASCIURUS</i>	<i>PEROMYSCUS MANICULATUS</i>	<i>PEROMYSCUS LEUCOPUS</i>	<i>SYNAPTOMYS COOPERI</i>	<i>CLEITHRONOMYS GAPPEI</i>	<i>MICROTUS PENNSYLVANICUS</i>	<i>ZAPUS HUDSONICUS</i>	<i>NAPAEZAPUS INSIGNIS</i>	NO. SPECIES	NO. INDIVIDUALS	PERCENT CATCH	
1. Stateline Run.....		1	10			6	3		1		2	1	7	24	16	147
2. Sawmill Run.....			5				2						2	7	8	87
3. Bone Run.....	1		15							11		3	4	30	10	294
4. Burned flats.....			4								1		2	5	5	99
5. Wolf Run.....			5				5			4	1		5	19	15	130
6. Quaker Run.....			11			1	1					1	5	16	12	138
7. Island, Quaker Bridge.....			3	1		9	35			19	17		6	84	21	394
8. Islands, Erie Station.....	1		10	1		4	7			8	3		6	24	60	40
9. Open field, Routes 17, 280.....			5				4			5	1		4	20	3	600
10. Gaging Station, Red House.....							9			12	1		4	27	8	320
11. Sphagnum Bog, A. S. P.....						3	5		5				3	12	13	94
12. Bear Caves, A. S. P.....			2			1	5	1	3	2		1	2	6	10	60
13. McCabe Trail, A. S. P.....			2				3						5	10	11	94
14. Tunungwant Swamp.....			17				5		1				2	5	5	100
15. Coon Run, A. S. P.....	2	2	2	1	1	11	3	2	1		4	39	11	85	17	505
20. Stoddard Creek, A. S. P.....			1			2	1		1		5		4	9	5	164
22. Stoddard Creek, A. S. P.....	3	11	5	1		1	9	2		20	1	7	10	60	29	210
24. A. S. P. No. 1, A. S. P.....	2	1	11			1	5			5	5	3	8	33	8	435
25. Stoddard Creek, Red House, A. S. P.....			2				3						2	5	3	170
27. Balsam Swamp.....																
Total.....	9	15	107	3	3	43	103	5	11	86	41	55	92	481	12	4,081

TABLE III

Summary of Measurements and Reproductive Data of Small Mammals
Mean and Range of Measurements and Weights are Given

SPECIES	TOTAL LENGTH (MM.)	TAIL LENGTH (MM.)	HIND FOOT LENGTH (MM.)	WEIGHT (G.)	NUMBER MALES	NUMBER FEMALES	NUMBER OF BREEDING MALES	NUMBER OF BREEDING FEMALES	DATES OF BREEDING FEMALES	NUMBER SPECIMENS AVERAGED
<i>Blarina brevicauda</i>	116.8 (102-140)	25.8 (22-32)	15.0 (13-16)	16.9 (10.5-22.7)	54	46	10	5	July 10, 18, 30; Aug. 1	100
<i>Sorex fumeus</i>	112.4 (110-117)	42.2 (39-47)	13.2 (12-14)	6.7 (6.1-7.6)	2	2	..	1	Aug. 1	5
<i>Sorex cinereus</i>	97.8 (90-102)	39.1 (37-42)	12.1 (11-13)	4.1 (3.1-5.4)	4	5	1	1	Aug. 24	9
<i>Peromyscus leucopus</i>	163.8 (114-186)	76.7 (64-94)	21.0 (19-23)	20.7 (11.1-34.4)	59	42	43	17	July 11, 18, 24; Aug. 1, 2, 6, 8, 13, 21-23	98
<i>Peromyscus maniculatus</i>	174.7 (146-196)	88.7 (71-105)	21.4 (20-24)	20.0 (13-26.5)	15	27	11	3	July 17, 26; Aug. 6	42
<i>Microtus pennsylvanicus</i>	155.1 (112-187)	45.0 (36-57)	20.8 (19-23)	35.4 (18.3-59)	41	38	19	11	July 12, 24; Aug. 1, 15, 16, 20, 23	62
<i>Clethrionomys gapperi</i>	134.8 (123-149)	41.0 (36-45)	18.7 (18-19)	24.0 (17.1-30.2)	10	3	8	..		11
<i>Synaptomys cooperi</i>	114.7	17.7	18.3	24.7	4	..	..	..		3
<i>Zapus hudsonius</i>	210.5 (181-239)	128.1 (110-146)	29.5 (28-31)	17.4 (12.2-25.5)	21	15	10	1	Aug. 23	36
<i>Napaeozapus insignis</i>	222.5 (196-246)	139.4 (121-155)	30.4 (29-32)	19.9 (10.9-30.3)	36	22	21	1	July 21	57
<i>Tamias striatus</i>	227.6 (218-244)	85.6 (71-90)	35.0 (33-38)	97.0 (94.8-98.8)	2	2	1	..		4
<i>Tamiasciurus hudsonicus</i>	304.0 (302-306)	119.0 (105-133)	50.5 (50-51)	195.7 (159.1-232.3)	1	1	..	..		2
<i>Myotis lucifugus</i>	88.3 (87-90)	37.3 (36-38)	10.3 (9-11)	6.2 (5.9-6.5)	2	1	2	..		3
<i>Pipistrellus subflavus</i>	81	39	11	4.9	1	..	..	..		1

TABLE IV
Fleas Taken from Trapped Mammals

SPECIES OF MAMMAL	SPECIES OF FLEA	NUMBER MALES	NUMBER FEMALES
<i>Didelphis marsupialis</i>	<i>Orchopeas leucopus</i> Baker	1	
<i>Marmota monax</i>	<i>Oropsylla arctomys</i> Baker	1	4
<i>Myotis lucifugus</i>	<i>Myodopsylla insignis</i> Rothschild		1
<i>Peromyscus</i> sp.	<i>Doratopsylla blarinae</i> C. Fox	1	1
	<i>Orchopeas howardii howardii</i> Baker		1
	<i>Orchopeas leucopus</i> Baker		1
<i>Peromyscus leucopus</i>	<i>Ctenophthalmus pseudagyrtes pseudagyrtes</i> Baker	1	
	<i>Doratopsylla blarinae</i> C. Fox		1
	<i>Orchopeas leucopus</i> Baker	3	6
	<i>Peromyscopsylla hesperomys hesperomys</i> Baker		3
<i>Peromyscus maniculatus</i>	<i>Ctenophthalmus pseudagyrtes pseudagyrtes</i> Baker		1
	<i>Orchopeas leucopus</i> Baker	2	2
	<i>Peromyscopsylla hesperomys hesperomys</i> Baker		2
<i>Synaptomys cooperi</i>	<i>Megabothris asio asio</i> Baker		1
	<i>Orchopeas howardii</i> Baker	1	
<i>Tamiasciurus hudsonicus</i>	<i>Orchopeas howardii</i> Baker		1

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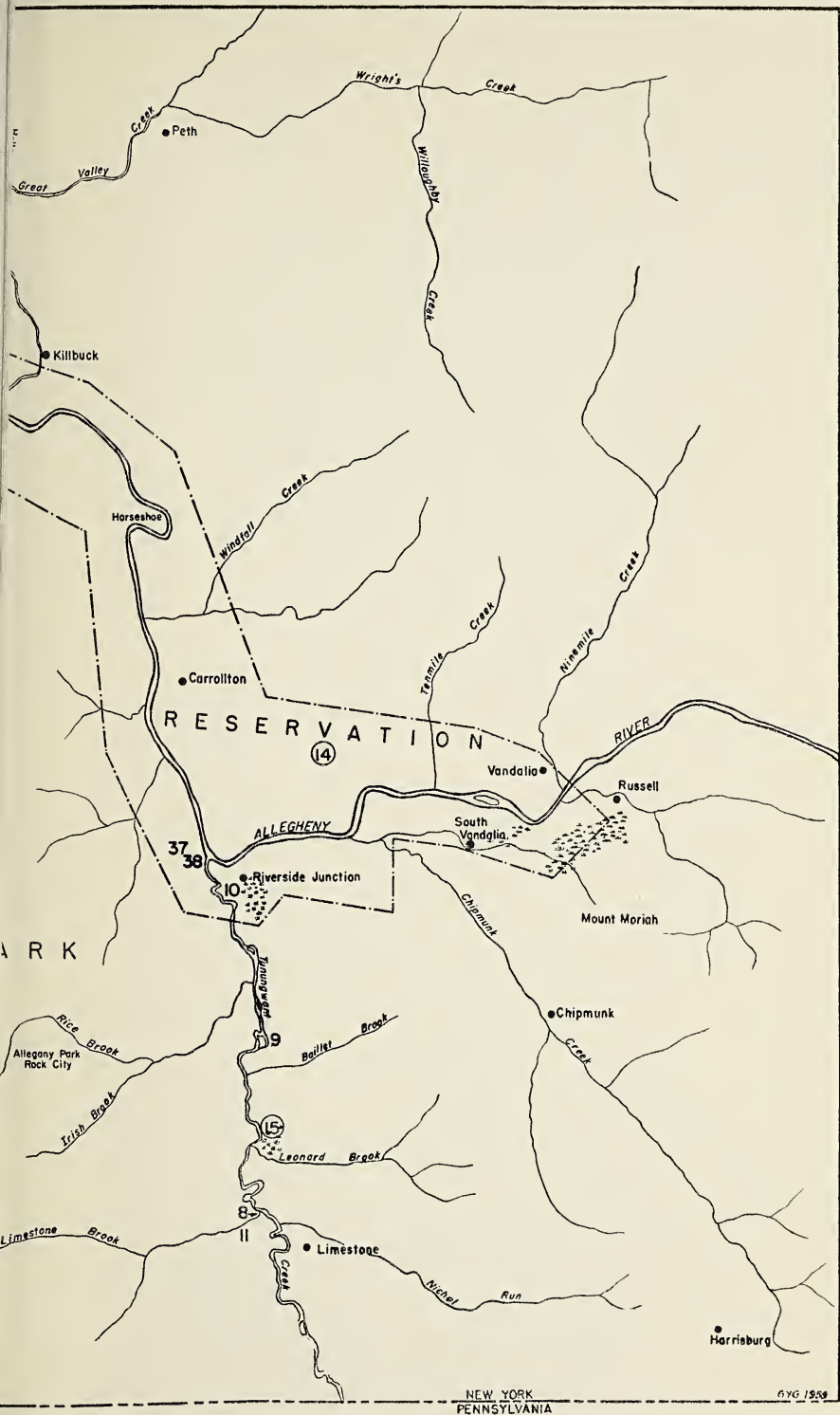
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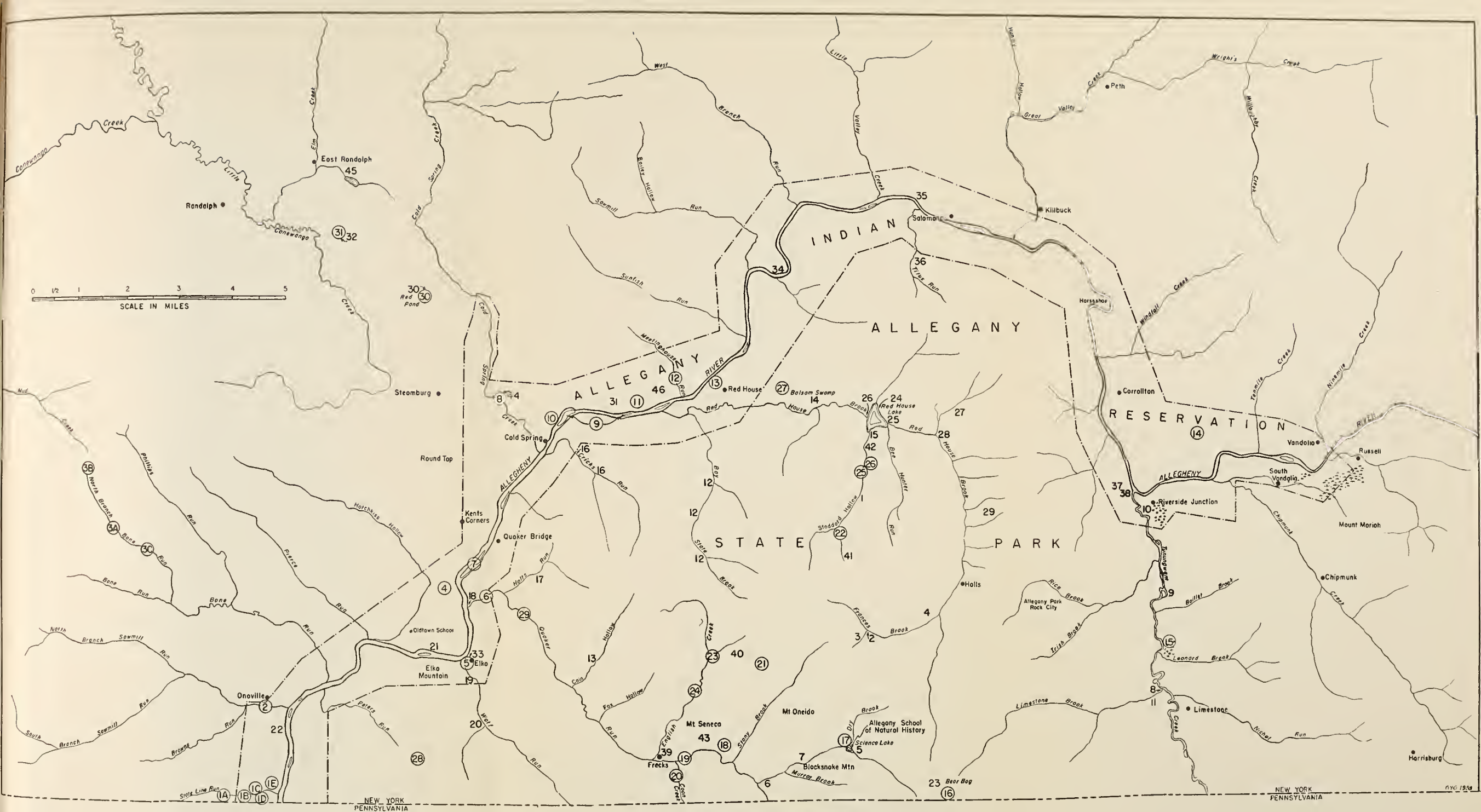


Figure 1. Allegheny Indian Reservation and vicinity, Cattaraugus County

Collection localities: George John Schumacher, circled numbers; Margaret M. Stewart, uncircled numbers

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a TYPOLOGY
and NOMENCLATURE
for NEW YORK
PROJECTILE POINTS



BY
WILLIAM A. RITCHIE
*State Archeologist
New York State Museum
and Science Service*

NEW YORK STATE MUSEUM
AND SCIENCE SERVICE

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*The University of the State of New York
The State Education Department*

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WILLIAM A. RITCHIE

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AND SCIENCE SERVICE
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CONTENTS

	PAGE
Introduction	5
Explanation	9
Table 1	10
Table 2	10
Adena points	12
Bare Island points	14
Brewerton Corner-Notched points	16
Brewerton Eared-Notched points	17
Brewerton Eared-Triangle points	18
Brewerton Side-Notched points	19
Clovis points	21
Fulton Turkey Tail points	23
Genesee points	24
Jack's Reef Corner-Notched points	26
Jack's Reef Pentagonal points	28
Lamoka points	29
Levanna points	31
Madison points	33
Meadowood points	35
Normanskill points	37
Orient Fishtail points	39
Otter Creek points	40
Perkiomen Broad points	42
Poplar Island points	44
Rossville points	46
Snook Kill points	47
Snyders points	49
Steubenville Lanceolate points	50
Steubenville Stemmed points	51
Susquehanna Broad points	53
Vosburg points	55
References	57

ILLUSTRATIONS

	PAGE
Figure 1—Standard projectile point terminology	11
Plate 1—Adena points	61
Plate 2—Bare Island points	63
Plate 3—Bare Island points	64
Plate 4—Brewerton Corner-Notched points	67
Plate 5—Brewerton Eared-Notched points	69
Plate 6—Brewerton Eared-Triangle points	71
Plate 7—Brewerton Side-Notched points	72
Plate 8—Clovis points	75
Plate 9—Fulton Turkey Tail points	76
Plate 10—Genesee points	77
Plate 11—Jack's Reef Corner-Notched points	79
Plate 12—Jack's Reef Pentagonal points	80
Plate 13—Lamoka points	83
Plate 14—Lamoka and "Dustin" points	85
Plate 15—Levanna points	87
Plate 16—Madison points	88
Plate 17—Meadowood points	89
Plate 18—Normanskill points	91
Plate 19—Orient Fishtail points	93
Plate 20—Otter Creek points	94
Plate 21—Otter Creek points	97
Plate 22—Otter Creek points	98
Plate 23—Perkiomen Broad points	99
Plate 24—Poplar Island points	101
Plate 25—Poplar Island points	102
Plate 26—Rossville points	103
Plate 27—Snook Kill points	104
Plate 28—Snyders points	105
Plate 29—Steubenville Lanceolate points	107
Plate 30—Steubenville Stemmed points	109
Plate 31—Susquehanna Broad points	111
Plate 32—Vosburg points	113
Plate 33—Points of exotic flint	114
Plate 34—Untyped bifurcated base points	115
Plate 35—Untyped narrow triangular points	117
Plate 36—Untyped broad-bladed, stemmed points	119

A Typology and Nomenclature for New York Projectile Points

WILLIAM A. RITCHIE
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NEW YORK STATE MUSEUM AND SCIENCE SERVICE

Introduction

LONG AND INTIMATE FAMILIARITY with the projectile points of the New York State area led the writer, quite some time ago, to a recognition of about 18 style categories, most of which could be related through site excavations to particular culture complexes and relative time periods. Subsequently, with radiocarbon dating, this chronological sequence was not only sustained but given an approximate actual value. Consequently, projectile point succession, as currently known, spans a period of about 5,000 years before the present.

Until rather recently, the author has discussed these projectile points in site reports and elsewhere in such general descriptive terms as broad, heavy, side-notched points, or narrow-bladed stemmed points, while at the same time exhibiting a tendency to refer to the very same points as Brewerton or Laurentian side-notched points, or Lamoka stemmed points, in accordance with the cultural associations he has been able to demonstrate through excavations.

The need for some convenient classification and nomenclature to replace this awkward phraseology has grown more insistent with the progress of research. The utility of a ceramic typology for the same area¹ encouraged the effort, which has currently attained to the dimensions indicated by the present publication. It seems safe to predict, especially in view of the still untyped points discussed below, that continuing research within the area will lead to the addition of new types, and, with some probability, to certain revisions of the series herein defined.

As the term is employed in this study, projectile points include: arrowpoints; dartpoints, or the armament of javelins or short throwing spears, hurled by hand either directly or with the aid of a dart thrower or atlatl; and spearpoints, or the stabbing heads affixed to relatively

¹ Ritchie and MacNeish, 1949; MacNeish, 1952.

long-handled thrusting weapons, not designed to leave the hand. Since in many, perhaps most, instances, the function cannot with certainty be deduced from the remaining part, the writer's attempts at such identification, where hazarded, are equivocal.

Furthermore, certain of the objects herein described (as in the Fulton Turkey Tail type) may have been primarily or interchangeably used as specialized cutting tools or knives. To the best of the author's knowledge and intent, however, only projectile point forms are included in this analysis.

The scope, as suggested by the title, is somewhat misleading, inasmuch as none of the point types herein defined is restricted in range to the geographical limits of the State of New York. In order, however, to achieve a reasonable delimitation to this initial effort for the area, it was decided to include only such point types as were known to have representation within the State's boundaries. It is hoped that other workers in the Northeast will add to the picture with similar analyses of point groups better represented and culturally known in their respective regions, so that ultimately a collation for the entire Northeast can be achieved.

In this typological study the author has been guided by the work of Rouse (1939, 1960), Krieger (1944) and others. The presentation of the data follows, in general, that of Scully (1951), Suhm, Krieger and Jelks (1954), Kneberg (1956) and Bell (1958). The methodology employed is that recommended by Krieger (1944, pp. 279-282) and may be outlined as follows:

1. The material was first sorted into major groups of generally similar points.

2. This sorting, or analysis, was governed by variations in the form, size, proportions, chipping characteristics etc., of such morphological features of the specimens as the blade, stem, notching, base etc., variously referred to by Rouse and Krieger, as "modes" or "attributes." (See figure 1.)

3. These formal variations in the inherent morphological features, modes or attributes became the basis for the tentative classification of the points into types.

4. The next step was the testing of the probable validity of the arbitrarily-constituted type by identifying it in collections from various sites or geographical areas. If it could be shown to persist as an entity with cultural, spatial and/or temporal (i.e., historical) associations, it was felt to be acceptable for the final step in the classification.²

² A total of 10,800 points from eastern, central and western New York were typed in this phase of the work in which the author was assisted by James H. Zell.

5. This step consisted in giving a name and description to the type group.

The description allowed for the observed range of variation in the modes, arising most likely from the vagaries encountered by individual makers in the execution, from a refractory material, of an ideal model or norm. It also provided for sufficient latitude or flexibility, so that minor variations in additional material of the same kind could be encompassed.

Finally, a nomenclature was provided, since the writer agrees with Krieger (1944, pp. 275, 277-279) that for maximum convenience, both in the construction and use of the typology, names, rather than numbers or letters in a classificatory system, should be used. The latter method of designation, usually derived from a geometric analysis and expressed in formulistic terminology, he finds awkward and difficult to remember.

Following Krieger's recommendation, he has chosen a locative nomenclature taken from the site or geographical locale where the type was first found or recognized, occurred most plentifully or was best culturally attributed. Linguistic, ethnic and cultural names (except where the latter is called from a type site; e.g., Lamoka) were avoided.

According to established usage, his descriptions include significant data concerning the age and cultural affiliations, distribution, literary references etc. Any previously employed terminology for the group is included in the latter.

Every effort has been made to avoid attaching new labels to already described point types. Wherever it could be shown, generally by submitting samples of specimens to the person responsible, that the group in question had already been named, the prevailing designation and definition or description (where available) were used explicitly and duly credited.³ Additional data from the New York sample have been clearly incorporated.

Certain fundamental assumptions, which the author shares with his colleagues whose methodology, in general, he has applied, underlie his work on this typology. These may succinctly be stated as follows:

The remarkable stylistic constancy in the modes or attributes, which undeniably can be demonstrated within a series of points collected over a wide geographical range or from numerous components of the same culture complex, indicates the reality of a stylistic model in the

³ The writer gratefully acknowledges cooperation of this kind from the following persons: Lewis R. Binford, Don W. Dragoo, W. Fred Kinsey III, William J. Mayer-Oakes and John Witthoft. For the loan of specimens used in this study, the writer is also indebted to Edward B. Christman, Thomas E. Daniels, R. Arthur Johnson, William J. Kirby, Museum of Anthropology of the University of Michigan, Rochester Museum of Arts and Sciences, Carl S. Sundler and James H. Zell.

minds of the prehistoric makers. Clearly they were working not from caprice but from a "cultural compulsive" which impelled them to conform to current fashions or established norms for their particular area and period. The surviving material product of this long extinct cultural concept can be recognized by the typologist and analyzed by means of definite morphological features of form, proportions etc., into various attributes or modes, as already outlined. Although these attributes are arbitrarily selected to conform to the purposes of the investigator, it is believed that the end product of the analysis approximates in important formal respects the ideal or norm of the maker.

It is further assumed that the typological configurations reflect standardized behavior and the fixation of motor habits, through traditional or culturally approved ways of doing things in the aboriginal society concerned. The strong conservatism, widely remarked for primitive societies, seems to be well illustrated in the marked degree of uniformity found within each of our point type categories (Boas, 1927, p. 145ff.; Redfield, 1953, pp. 14, 120).

Finally, it should be made explicit that in these statements regarding the "recapture" of ancient cultural concepts, the author is fully aware that, as Rouse and others have pointed out, "Culture does not consist of artifacts. The latter are merely the results of culturally conditioned behavior performed by the artisan. Types and modes express the culture which conditions the artisan's behavior." (Rouse, 1939, p. 15.)

In more philosophical phraseology, "All records show only the apparent forms of the truly existing inner reality." (Wilhelm Dilthey, quoted in Kluback, 1956, p. 60.)

As has been stated on page 6, the probable validity of the typology derived in the present study from the combination of a background of long familiarity with the materials and the specific analysis of several thousand specimens, was tested in the fourth step of the procedure by application to 10,800 additional projectile points. These formed part of two New York State Museum collections and one private collection from surface sites which were selected to represent an equal number of areas in the State. They came, respectively, from the middle regions of the Hudson River Valley (Greene and Rensselaer Counties), the Seneca River Valley (Onondaga County), and the Genesee River Valley (Livingston County).⁴

⁴ This investigation will be expanded to include more large collections, both public and private, from the same and other areas. In addition to typological data, significant distributional information is being accumulated for expanded treatment in a subsequent report.

The analysis of this large sample resulted in a remainder of 917 points (.084 percent of the total) which could not with certainty be attributed to the 27 types herein described. Some of the difficulty in typing the material arose from the lack, in certain specimens, of "crisp" diagnostic criteria or from the presence, in others, of typologically interlinking features. There were also a fair number of points too crudely made to render determinate the essential form and a much smaller number which showed obscuring secondary alterations.

From this untyped residue of 917 points can be extracted at least the three following small groups:

1. Bifurcated base points totaling 48 (plate 34)
2. A long, narrow, triangular form, with 35 examples (plate 35)
3. A broad-bladed, stemmed form, represented by 34 points (plate 36). Some of these resemble Snook Kill points and may be variants of that type. (See plate 27.)

The bifurcated forms, on the basis of scanty existing data, apparently cannot be unified by their prominent attribute of stem bifurcation. On the other hand, when the samples can be expanded and cultural and temporal data supplied, the triangular and broad, stemmed forms may become candidates for additional types.

There are left 800 points, from which can be isolated six or seven small lots. Each consists of a dozen or less points in which the similarity is sufficient to hint at type categories from future research.

In accounting for the others, it is likely, especially where the material as well as the form is exotic to the area, that an indeterminate number may be erratics from undescribed point groups of distant proveniences. (See plate 33.) Among the rest are a fair number of specimens that may plausibly be regarded as aberrant objects resulting from accidents of the chipping process, perhaps from technical difficulties with the material; from the artisan's caprice; or, perhaps, even from his experimental design, unique and unadopted, since the element of inventiveness must be admitted to account originally for some unknown portion of all point styles.

EXPLANATION

In the following descriptions the projectile point types are arranged alphabetically, in accord with the usual procedure. A single very typical specimen ("holotype") is reproduced natural size from a carefully made drawing showing details of the chipping characteristics, with descriptive text for each group. Following this, one or more photographic assemblages depicting the range in size and form of the type, are given, with data on provenience, material and ownership.

To aid the general student in identifying his own material, the point types are also listed below under two categories: (1) by major period provenience, table 1; and (2) by their principal morphological attribute characteristics, table 2. To more readily comprehend the latter, the standard terminology for projectile points is shown in the illustration, figure 1, on page 11.

Table 1
Major Period Provenience of Projectile Point Types

GENERAL PERIODS	PROJECTILE POINT TYPES	GENERAL PERIODS	PROJECTILE POINT TYPES
Late Woodland	Madison Levanna		Genesee Brewerton Eared-Triangle Brewerton Eared-Notched
Middle Woodland	Jack's Reef Pentagonal Jack's Reef Corner-Notched Snyders	Middle Archaic	Normanskill Brewerton Corner-Notched Brewerton Side-Notched Otter Creek Vosburg
Early Woodland	Adena Fulton Turkey Tail Meadowood	Early Archaic	Lamoka
	Steubenville Lanceolate (?) Steubenville Stemmed (?) Orient Fishtail	Paleo-Indian	Clovis
Transitional and Late Archaic	Susquehanna Broad Perkiomen Broad Rossville Bare Island Poplar Island (?) Snook Kill (?)		

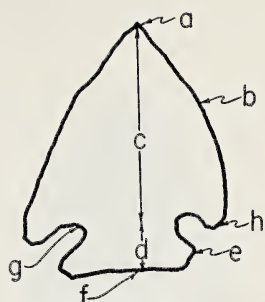
Table 2
Point Types Grouped by Primary Morphological Feature

Side-Notched Points	Contracting Stemmed Points
Brewerton Side-Notched	Adena
Brewerton Eared-Notched	Poplar Island
Fulton Turkey Tail	Rossville
Lamoka (in part)	Snook Kill
Meadowood	
Normanskill	Expanding Stemmed Points
Otter Creek	Orient Fishtail
Corner-Notched Points	Perkiomen Broad
Brewerton Corner-Notched	Susquehanna Broad
Jack's Reef Corner-Notched	
Snyders	Stemless Points—Triangular or Lanceolate
Vosburg	Brewerton Eared-Triangle
Straight Stemmed Points	Clovis
Bare Island	Jack's Reef Pentagonal
Genesee	Levanna
Lamoka (in part)	Madison
Steubenville Stemmed	Steubenville Lanceolate

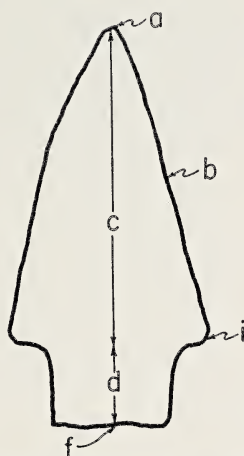
NEW YORK PROJECTILE POINTS



SIDE - NOTCHED



CORNER - NOTCHED



STRAIGHT STEMMED



CONTRACTING STEMMED



EXPANDING STEMMED



TRIANGULAR



LANCEOLATE

FIGURE 1—STANDARD PROJECTILE POINT TERMINOLOGY: a, point or tip; b, edge; c, blade or face; d, stem; e, tang; f, base; g, notch; h, barb; i, shoulder.

ADENA POINTS (plate 1)



General description: Large points with broad, lobate stems.

Size: According to Bell (1958, p. 4) most points of this type measure between 3 and 5 inches in length. In a sample of 50 from New York, the shortest was $1\frac{1}{16}$ inches, the longest 4 inches, with the majority falling between 2 and 3 inches. In thickness, the New York sample varied from $\frac{1}{4}$ to $\frac{7}{16}$ of an inch; nearly all, however, fell between $\frac{5}{16}$ and $\frac{3}{8}$ of an inch. Such points are generally considered dart points. Longer, probable spear points, also occur. (See e.g., Ritchie and Dragoo, 1960, plate 8, figure 6).

Proportions: For the most part, about two to two and one-half times as long as wide.

Shape: Blade generally ovoid in outline; some of the narrower specimens could be described as lanceolate; biconvex to nearly flat in cross section; edges excurvate. Shoulders weak to moderate in development, never barbed, sloping to approximately right angular in profile. Stem broad, long, contracted, lobate in outline, with convex, sometimes nearly pointed base. While stem grinding is reported for some Adena points, it is absent in the New York sample studied.

Age and cultural affiliations: This is the characteristic point style of the Adena culture, of Early Woodland times, radiocarbon dated between about 800 B.C. and A.D. 800. It is also a trait of the Middlesex complex in the Northeast, which is believed to have been derived in part from the Adena (Ritchie and Dragoo, 1959, pp. 43-50; 1960, p. 26ff.).

Kneberg says that "the type is also associated with the late Archaic culture in the Tennessee area, dating from about 1000 B.C. to the early centuries A.D." (Kneberg, 1956, p. 26.)

Distribution: "The Adena type is found chiefly in the upper Ohio River Valley, especially the states of Ohio, Kentucky, Indiana, West Virginia and Pennsylvania." (Bell, 1958, p. 4.) It has an uncertain peripheral distribution which includes Tennessee and New York.

NEW YORK PROJECTILE POINTS

References: Kneberg, 1956, pp. 26-27; Bell, 1958, pp. 4-5; Ritchie, 1958, pp. 100-102, where it is called a "lobate stemmed point"; Ritchie and Dragoo, 1960.

Remarks: In the upper Ohio Valley area Adena points are frequently made of Flint Ridge, Ohio chalcedony or of Harrison County, Indiana flint. Specimens made of these materials are also known from New York, but most New York examples are of regional flints—Onondaga, Oriskany, Helderberg, Normanskill, Deepkill, Fort Ann—or very rarely of quartz. These seem to be local copies, in readily available materials, but often on a somewhat smaller scale, of introduced Adena points.

BARE ISLAND POINTS (plates 2 and 3)

This description was prepared by W. Fred Kinsey III.



General description: Medium to large, finely flaked, symmetrical points, having slender isosceles triangular blades. The stem is straight with parallel sides and the base is also straight.

Size: They range from 1.2 inches to 3.8 inches long with the average length slightly over 2 inches. In cross section they are oval and relatively thick.

Proportions: Blade width is between $\frac{1}{2}$ and $\frac{1}{3}$ of the total length. A rather slender shape predominates, although extreme narrow-bladed examples are in the minority.

Shape: The blade exhibits considerable symmetry in the form of an isosceles triangle. Edges are generally slightly convex with the edges on the larger specimens tending to be straighter. Greatest convexity usually occurs at the middle of the blade. Tips are sharply pointed and are always on center with the stem although there is no distinct medial ridge. Points made of quartz are thicker than those fashioned from other lithic materials. Probably this is a function of the way quartz flakes, rather than a trait of cultural significance.

Shoulders are slightly rounded and tapered but not conspicuously so. On a few specimens the shoulders are quite sharply angled and well defined. An obtuse angle is formed between the blade and stem, but in some instances a right angle is present. There are intergrades between the Bare Island point and the Poplar Island point, but the rounded shoulder is conspicuous on the latter type. This is a distinguishing characteristic. The shoulder on the Bare Island point is more crisp.

The stem is always narrower than the blade. The long sides of the stem are parallel or nearly so forming a nearly perfect square or rectangle. The base is usually quite straight, but it is sometimes slightly convex. A few examples intergrade with a large corner-notched point form that has an expanded stem. There are often traces of grinding

along the stem edges and at the base. Corners approach right angles and on some specimens they are quite sharp.

Age and cultural affiliations: This is a distinctive point type found on numerous Archaic sites in the lower Susquehanna watershed. It is more abundant on the islands of the Susquehanna rather than the hilltop sites back from the river. Although not found as yet in any deeply stratified sites, it is the major point type in all levels at the Kent-Hally site on Bare Island. It is also abundant at the Fallen Tree site on the same island. The type is presumed to be part of a varied and complex Late Archaic. Locally, the author believes it is contemporaneous with steatite bowls.

Similarities between the Bare Island point and a component of the Accokeek Creek site on the lower Potomac River, south of Washington, D.C., are striking. It may be that the antecedent for this type lies in the Virginia and Carolina Piedmont and the Savannah River in Georgia.

Distribution: The type is found in the lower Susquehanna Valley, particularly the river islands. It extends southward along Elk River in Maryland, the Chesapeake and the lower Potomac. East of the Susquehanna, it is found along the headwaters of the White Clay Creek and the Brandywine in Chester County. West of the Susquehanna, it is not common in the Adams and Franklin County sections of the Cumberland Valley. The writer believes the distribution is also spotty along the west and north branches of the Susquehanna.

[The distribution of these points extends across New Jersey into southern and eastern New York. They occur in some abundance on Staten Island and Long Island, and with diminishing frequency northward up the Hudson Valley, at least to Saratoga County. The Ctl. 1 site in Greene County provided a sample of 114. In the southern part of this range, quartz is the commonest material. Farther north flint predominates, although quartz and quartzite are still present. (See plate 3). W.A.R.]

References: Kinsey, 1959, p. 115, where they are called "straight-stemmed, Type A."

Remarks: At the Kent-Hally site nearly 50 percent of these points were made of quartz. Other locally available stones in order of preference are: siltstone, quartzite, rhyolite, argillite, and a very few of flint, gneiss and schist. No attempt was made to utilize the available flint and jasper sources. The reasons for this cultural preference are unknown.

BREWERTON CORNER-NOTCHED POINTS (plate 4)



General description: Broad, thick, corner-notched points, predominantly of medium size.

Size: Length range from about $\frac{15}{16}$ to $3\frac{1}{8}$ inches. Majority fall between $1\frac{1}{4}$ and $2\frac{1}{4}$ inches.

Thickness about $\frac{3}{16}$ to $\frac{3}{8}$ of an inch; majority about $\frac{5}{16}$ of an inch.

Proportions: These points are one and one-fourth to one and one-half times as long as wide. The larger examples are about twice as long as wide.

Shape: Blade trianguloid in outline, biconvex in cross section; edges slightly excurvate, less often straight, or rarely incurvate. Stem corner-notched with medium to large corner notches forming prominent barbs, and basally expanded. Base straight, slightly convex or rarely slightly concave. About two-thirds have the base ground smooth.

Age and cultural affiliations: This constitutes a minority point type in the Archaic Brewerton complex of Laurentian and in the Frontenac complex in New York. There is some evidence that it appeared later than the Brewerton Side-Notched type in the Brewerton complex. The Vosburg Point of the eastern New York manifestation of Laurentian differs from the Brewerton Corner-Notched type in its shorter stem, smaller notches and usually weaker barbs. The two forms overlap, however, and appear to be genetically related and generally contemporaneous.

Distribution: Primarily a central and western New York form. Present also in eastern New York with occasional examples as far south as central New Jersey. Similar points occur also as a minor and relatively late type on sites attributed to the Laurentian of the upper Ohio Valley (Dragoo, 1959, pp. 162, 176-180).

References: Ritchie, 1940, pp. 29, 48-49, 66, 88, where they are described as "corner-notched points." Subsequently the writer has referred to them as "broad corner-notched points."

Remarks: Usually made of local Onondaga gray flint and apparently in the same manner as the Brewerton Side-Notched form.

BREWERTON EARED-NOTCHED POINTS (plate 5)



General description: Generally broad, thick, weakly side-notched points, small to medium in size, characterized by a broad base with flanges which often project beyond the edges and, for the most part, have been carefully chipped into small and delicate prominences or "ears."

Size: The length range is from $\frac{3}{4}$ to $2\frac{1}{2}$ inches, the majority being between 1 and $1\frac{1}{2}$ inches long. Thickness $\frac{3}{16}$ to $\frac{5}{16}$ of an inch, with $\frac{1}{4}$ of an inch for most examples.

Proportions: About one and one-half to two times as long as wide.

Shape: Blade trianguloid or ovoid in outline, biconvex in cross section; edges prevailingly excurvate, less frequently straight. Stem broad, with small side notches and pronounced lateral, carefully chipped "ears." Ears and base, the latter in most instances slightly concave, occasionally straight, are sharp, except in a very few examples where they are ground smooth.

Age and cultural affiliations: A minority type in the Brewerton complex, where it constitutes 8 percent of the projectile point inventory at the Robinson site, but is barely represented at the nearby Oberlander No. 1 station. Present also as a minority form on Middle and Late Archaic period sites in eastern New York and southern New England.

Distribution: Central and eastern New York and southern New England, especially Massachusetts.

References: Ritchie, 1940, pp. 28, 66, where it is called the "eared notched point;" 1958, where it is referred to throughout as the "eared side-notched point."

Remarks: This point type was probably derived from the Brewerton Side-Notched type in upper Middle Archaic times. The material of the Brewerton series in central New York is Onondaga flint; of the eastern New York series, predominantly local flints.

BREWERTON EARED TRIANGLE POINTS (plate 6)



General description: Relatively thin, isosceles triangular points, small to medium in size, distinguished by small, delicately chipped "ears" on either side of the base.

Size: Only one site has produced a sizable sample of these points, the Robinson site at Brewerton, N.Y. As represented by the 60 such points at this site, the length range is from $\frac{7}{8}$ to $2\frac{1}{8}$ inches, the majority falling between $1\frac{1}{16}$ and $1\frac{1}{2}$ inches.

Proportions: About one and one-half to two times as long as wide.

Shape: Blade trianguloid or ovoid in outline, biconvex in cross section; edges prevailinglly excurvate, occasionally straight. Stemless, base broad and slightly concave or infrequently straight. Very delicately chipped "ears" occur on either side of the base, which in some examples has been rubbed smooth.

Age and cultural affiliations: Like the evidently related Brewerton Eared-Notched point, this is a minority type in the Brewerton complex, where it comprises only 5.38 percent of the total point series at the Robinson site, and is barely represented at the nearby Oberlander No. 1 site. It also occurs occasionally in eastern New York sites of the Laurentian tradition and in related sites of southern New England. The author regards it as a type of the upper Middle and Late Archaic horizons in these several areas.

Distribution: Central and eastern New York and southern New England, especially Massachusetts.

References: Ritchie, 1940, pp. 32, 67, where it is described as the "eared-triangular point."

Remarks: This type intergrades with the Brewerton Eared-Notched type and may well have developed from it. Most examples from the Brewerton sites are of local flints, carefully made by pressure flaking techniques.

BREWERTON SIDE-NOTCHED POINTS (plate 7)



General description: Broad, thick, side-notched points, predominantly of medium size.

Size: Length range from about $1\frac{3}{16}$ to $3\frac{7}{8}$ inches, prevailing between $1\frac{1}{4}$ and $2\frac{1}{4}$ inches.

Thickness about $\frac{1}{4}$ to $\frac{1}{2}$ inch; $\frac{5}{16}$ to $\frac{3}{8}$ of an inch for the large majority.

Proportions: These points are one and one-fourth to one and one-half times as long as wide. The larger examples are about twice as long as wide.

Shape: Blade trianguloid in outline, biconvex in cross section; edges slightly excurvate, straight, or rarely incurvate; faintly serrated in rare instances. Stem side-notched (occasionally with dual notches) and basally expanded, sometimes to a pronounced degree, resulting in lateral projections or "ears." Base straight, slightly convex or less often mildly concave. About two-thirds of all specimens have the base ground smooth.

Age and cultural affiliations: This is the commonest point of all Archaic Laurentian complexes of New York.

Distribution: All of New York. Also a dominant type on upper Ohio Valley sites attributed to the Laurentian (Dragoo 1959). It is a minority type on certain southern New England Archaic sites and is present in Laurentian and Laurentian-like contexts in southern Ontario, Pennsylvania and elsewhere in the Northeast.

References: Ritchie, 1940, pp. 28, 64-66, where they are termed "side notched points." In later reports the writer has called them "broad side-notched points."

Remarks: These points probably were, for the most part, javelin heads. The larger sizes seem to have been spearpoints, while the smaller variety could apparently have served as arrowpoints. It is, however, unlikely that the bow and arrow was a hunting device at the period, probably from around 3000 B.C. to early A.D. when this type of point seems to have been used. Some of the more convex

edged specimens, especially those with short blade, were likely knives. Rechipping to sharpen may account for some of the short-bladed examples (plate 7, figure 8) and this process would accentuate the proportions of the base.

For the most part these points seem to have been manufactured by percussion chipping from local flints. Pressure flaking to produce a sharp retouched edge is common.

The Brewerton Side-Notched point is probably related to the Otter Creek point (plate 20 and pp. 40-41 herein), the Black Sand Notched (Scully, 1951, p. 10), the Big Sandy Side-Notched (Kneberg, 1956, p. 25), and other forms, including very similar examples from the Shell Mound complex of the Southeast. The writer suspects it is genetically related to other very old and widely-distributed, side-notched, American projectile points.

CLOVIS POINTS (plate 8)



General description: Narrow, fluted, lanceolate points, of medium to large size, with concave bases.

Size: Length range from about 1 to 5 inches. The majority, in a series of 66 such points from New York State, measure between about $2\frac{1}{2}$ and $3\frac{1}{2}$ inches in length, and between $\frac{3}{16}$ and $\frac{5}{16}$ of an inch in maximum thickness (range $\frac{1}{8}$ to $\frac{3}{8}$ of an inch).

Proportions: Two to four times as long as wide.

Shape: Lanceolate, with parallel or excurvate edges and concave base. Basal and lower lateral edges usually ground smooth. Both faces (rarely only one) fluted, the channel scars extending for varying distances on either side from base to tip. Frequently more than one channel flake was struck off on each face.

Age and cultural affiliations: Early paleo-Indian. Recent radiocarbon dates from

the Lehner site, a mammoth kill site in southeastern Arizona with Clovis points, indicate an antiquity of 11,000 to 12,000 years (Haury, Sayles and Wasley, 1959, pp. 24-25) for the Llano complex to which the Clovis point type has been assigned, at least in the western United States (Sellards, 1952, pp. 17-18).

Carbon 14 dates averaging about 9,000 years ago have been obtained for the Bull Brook site in northeastern Massachusetts (Byers, 1959), where Clovis type points comprise part of a paleo-Indian chipped stone tool complex, having parallels elsewhere in the eastern United States.

Distribution: Chiefly as surface finds without faunal or cultural associations, the Clovis point is widely distributed throughout the United States and southwestern Ontario. Definite components, with faunal associations, mainly mammoth remains, have been found in the American Southwest and High Plains; without faunal associations

in the eastern United States from Tennessee to Vermont. Sporadic point occurrences are known from Mexico, western Canada and Alaska.

References: Wormington, 1957, pp. 42-84; Sellards, 1952, pp. 17-46; Suhm, Krieger and Jelks, 1954, p. 412; Ritchie, 1957; Bell, 1958, p. 16.

Remarks: Clovis points are generally skillfully and carefully made, apparently by pressure flaking techniques. The stone material is usually a high grade mineral which frequently is exotic to the area where the points are found.

The Clovis type point should not be confused with the Folsom type, which is also fluted, and which has a much more limited distribution within the western part of the United States. The Folsom type, which at the Blackwater No. 1 locality, New Mexico, has been found stratigraphically above the Llano complex containing the Clovis type, was probably developed from it by paleo-Indian groups in the High Plains who hunted bison of now extinct species (Sellards, 1952, pp. 29-31). A radiocarbon date of $9,883 \pm 350$ years ago has been determined for a Folsom component near Lubbock, Texas (Sellards, 1952, pp. 52-55).

The Folsom point is described by Wormington (1957, p. 263) as "A more specialized type, of excellent workmanship, thought to be derived from the Clovis type. There is some overlap in size between Clovis and Folsom points, but the latter are lighter and usually smaller. They range in length from three quarters of an inch to three inches with an average of about two inches. They are lanceolate in outline and have concave bases usually marked by ear-like projections. There is frequently a small central nipple in the basal concavity. The points were fluted through the removal of longitudinal flakes. The flutes usually extend over most of the length of the point. In most cases one major channel flake was removed from each face, but sometimes only one face was fluted. Most specimens have a fine marginal retouch. The lower edges usually bear evidence of grinding."

FULTON TURKEY TAIL POINTS (plate 9)

Although probably a knife blade rather than a projectile point, this type is listed and described in Scully's paper on projectile point typology (Scully, 1951, p. 11). A small number of specimens have been found in New York, chiefly in the central part of the State, in the Seneca and Oneida Rivers region.

The following description, except for the few New York specimens available, is taken from Scully (*op. cit.*).

"Material: Chipped stone. [All examples of this type seen by the writer were made from Harrison County, Indiana, gray or blue-gray nodular flint. The surface-found New York specimens have weathered to a tan or brown color, the lighter concentric rings in the mineral sometimes weathering almost white. The flaking was very skillfully accomplished by a pressure technique which left broad, flat scars. Fine marginal retouching is universally present.]

"General description: Leaf shaped, pointed at both ends and side notched at one end.

"Size: Average—about 6 inches. [The New York examples range from $3\frac{3}{4}$ to 6 inches long and average $\frac{1}{4}$ of an inch in maximum thickness.]

"Proportions: Three times as long as the widest point.

"Shape: Body—pointed at both ends with widest portion halfway up the length of point.

Notches—shallow, rounded, narrow, side notches located about $\frac{1}{10}$ length from end of point.

"Variants: Proportions vary as do the position of the notches.

"Association: Usually with late Archaic or early Woodland. [A specimen of this kind was found by the writer in a grave of the early Point Peninsula complex, Early Woodland period, on the Oberlander No. 2 site at Brewerton, Oswego County, N.Y. (See Ritchie, 1944, pp. 152-160, plate 71, figure 13. Slight damage to the base of this artifact has resulted in the loss of the characteristic point.) Charcoal from one of the burials, all cremated, in this cemetery, yielded a radio-carbon date of 998 B.C. $\pm$ 170 years (Chicago sample No. 192. Arnold and Libby, 1951, p. 114).

It is a diagnostic trait of the Red Ocher culture of the upper Great Lakes region.]

"Distribution: Central Illinois, eastern Missouri, and southern Illinois and Indiana. [To this range we may add Ohio and central New York.]

"Reference: Titterington, 1950." [Scully, 1951, p. 11.]

GENESEE POINTS (plate 10)



General description: Large, thick, straight stemmed points, of medium breadth.

Size: Length range is from approximately $1\frac{1}{2}$ to 6 inches; the majority falling between 3 and $3\frac{1}{2}$ inches. Specimens longer than 6 inches occasionally occur or are indicated by broken basal sections. Thickness varies from about $\frac{5}{16}$ to $\frac{9}{16}$ of an inch, with most points measuring between $\frac{3}{8}$ and $\frac{7}{16}$ of an inch.

Proportions: Typically about 2 to $2\frac{1}{2}$ times as long as wide.

Shape: Blade trianguloid in outline, markedly biconvex in cross section; edges straight or slightly excurvate. Stem rectangular and straight or parallel-sided. Shoulders weakly to moderately developed, with straight or slightly oblique basal edge. Base straight. About 40 percent show slight grinding of base and sides of stem.

Age and cultural affiliations: Apparently Middle to Late Archaic; part of Laurentian and Frontenac manifestations. Examples were found among the grave goods of 9 burials at Frontenac Island (Ritchie, 1945, pp. 48-80). Radiocarbon dates at this site range from 2980 B.C. $\pm$ 260 (C-191, Arnold and Libby, 1951, p. 114), through 2013 B.C. $\pm$ 80 (Y-459), to 1723 B.C. $\pm$ 250 (W-545).

Distribution: Central and, particularly, western New York and westward across the Niagara Peninsula of Ontario. Especially numerous in the Genesee Valley of New York and the Grand River Valley of Ontario. To a much lesser extent they occur also in eastern New York and southern New England.

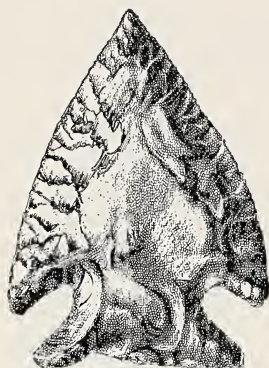
References: Ritchie, 1940, p. 29; 1945, p. 30, where they are referred to as "stemmed" and "broad stemmed" points, respectively.

Remarks: Genesee points seem to have served as dart or spear points, perhaps in a few cases as knives. A very large percentage are made from the characteristic mottled gray and brown flint of the Onondaga escarpment of western New York and adjacent Ontario, most of the remainder being of the more uniform gray Onondaga chert of central New York.

Broad, shallow chipping scars suggest percussion technique of manufacture. Marginal retouching is evident in many specimens and probably signifies pressure work.

These points bear a marked similarity to the Kays Stemmed, a Middle to Late Archaic type of the Tennessee area (Kneberg, 1956, p. 26), and to straight stemmed points from the Shell Mound complex of Kentucky (compare, e.g., with figure 32, A. Webb, 1946).

JACK'S REEF CORNER-NOTCHED POINTS (plate 11)



General description: Broad, thin, corner-notched points of medium size, frequently having angular edges.

Size: Length range from about 1 to $2\frac{1}{4}$ inches; for the most part, between $1\frac{3}{4}$ and 2 inches. Maximum thickness $\frac{3}{16}$ to $\frac{1}{4}$ of an inch, the majority do not exceed the minimum figure. There is one larger specimen, probably a spearhead of this type, measuring 4 inches in length, but only $\frac{5}{16}$ of an inch in thickness (plate 33, figure 2).

Proportions: About one and one-fourth times as long as broad.

Shape: Ovoid or pentagonal in outline, and flat or nearly so in cross section. Edges excurvate or angular. Stem corner-notched and basally flaring, barbs small to large, thin and sharp. Base straight, and occasionally slightly smoothed.

Age and cultural affiliations: Later Middle Woodland times and the earlier part of the Late Woodland period.

Its principal period of use in New York encompassed Point Peninsula 2 and 3 complexes and the early Owasco Carpenter Brook complex. One site of the latter complex (White site, Norwich, N.Y.) has been radiocarbon dated at A.D. 905 ± 250 years (M-176, Crane, 1956, p. 668).

It appears to be one of the forms found in the Intrusive Mound culture graves at the Mound City Hopewell group in Ross County, Ohio (Mills, 1922, p. 579 and figure 94).

Distribution: A major center of use was the Seneca River area of central New York, where it has been found in the burials and/or refuse of the Kipp Island, Jack's Reef, Bluff Point, Wickham and other sites, and on much more numerous surface sites. It is sporadically distributed in western, northern and eastern New York. As already mentioned, it occurs in Ohio, which was probably a primary center of dispersal into New York.

NEW YORK PROJECTILE POINTS

References: Ritchie, 1944, pp. 132 ff., plate 59, figures 8, 14-18, 20, 22-25; p. 173, plate 77, figures 6-8; 1946, p. 20, plate 6, figure 23; 1958, plate 14, figures 5, 6. According to blade outline, the point is alluded to in these references as "broad corner-notched" or "corner-notched with angular edges."

Remarks: This point takes its name from the late Point Peninsula Jack's Reef site in Onondaga County, N.Y., excavated by the writer in 1947 and 1951 (ms. report on file at New York State Museum and Science Service).

Materials include not only central New York Onondaga flint, but eastern Pennsylvania jasper and Flint Ridge, Ohio chalcedony. The points appear to have been made by carefully controlled pressure flaking.

JACK'S REEF PENTAGONAL POINTS (plate 12)



General description: Broad, stemless, pentagonal points.

Size: Range in length from 1 to $1\frac{3}{4}$ inches; majority measure between $1\frac{1}{4}$ to $1\frac{1}{2}$ inches, with a maximum thickness of $\frac{3}{16}$ of an inch.

Proportions: About one and a third times as long as wide.

Shape: Pentagonal, usually with straight sides. Sides, however, may be slightly contracting. Base straight, rarely concave.

Age and cultural affiliations: A larger, thicker and cruder variant (up to $2\frac{1}{4}$ inches long) appears in the Brewerton complex (Middle Archaic). A few smaller, but still crude, examples occur in the middle or Point Peninsula 2 complex (later Middle Woodland). It constitutes a minor, but well-executed form on late Point Peninsula (Point Peninsula 3), and especially on sites which show transitional features into the early Owasco (lower Late Woodland) complex, where it continues, however, as a minor point type. The best example is the White site, near Norwich, Chenango County, N.Y., radiocarbon dated at A.D. 905 ± 250 years (M-176, Crane, 1956, p. 668).

Like the Jack's Reef Corner-Notched point, with which it coexists on both Point Peninsula and Owasco sites in New York, it was present in the Intrusive Mound culture graves at the Mound City Hopewell group in Ross County, Ohio (Mills, 1922, p. 579 and figure 94).

References: Ritchie, 1940, pp. 30-31; 1944, pp. 89, 107, 133; 1946, p. 39. They are termed "pentagonal-shaped points" in these references.

Distribution: Very similar to the Jack's Reef Corner-Notched type. In central and eastern New York it has been found in refuse and/or burials on the Robinson, Wickham, Jack's Reef, Kipp Island, Bluff Point, White and Schermerhorn sites.

It occurs, as mentioned, in Ohio. A similar form is described for Virginia (Holland, 1955, pp. 167-168).

Remarks: Named from the late Point Peninsula Jack's Reef site in Onondaga County, excavated by the writer in 1947 and 1951 (ms. report on file at the New York State Museum and Science Service).

Materials, local flints. Technique, pressure flaking.

LAMOKA POINTS (plates 13 and 14)



General description: Small, narrow, thick points, with weak to moderately pronounced side notches, or straight stemmed with slight, usually sloping shoulders.

Size: The length ranges from less than one inch to about $2\frac{1}{2}$ inches. The majority fall between $1\frac{1}{4}$ and $1\frac{3}{4}$ inches in length, and measure about $\frac{1}{4}$ of an inch in maximum thickness. There are a few longer points, believed to be spearheads, which range up to $5\frac{3}{8}$ inches in length. (Ritchie, 1932, plate V, figures 28-30.)

Proportions: Two to three times as long as wide.

Shape: Blade trianguloid in outline, biconvex or median ridged in cross section; edges straight or slightly excurvate. Stem straight and of moderate length or side-notched. Base straight, oblique, or slightly convex, usually unworked and as thick as blade, often exhibiting broad, unmodified surface of flake or pebble from which point was made. This thick, "unfinished" condition of the base is a prime diagnostic feature of the Lamoka point wherever found.

Age and cultural affiliations: The characteristic point form of the Lamoka complex, for which radiocarbon dates ranging from about 3500 B.C. to 2500 B.C. have been obtained. Both the side-notched and stemmed forms occur together in the same Lamoka components at the same levels, although the proportions vary somewhat from site to site, as noted in the site reports. The type apparently persisted in very minor proportions down to Middle Woodland times, at least in central New York.

Distribution: This type has a wide range beyond the known area of the defined Lamoka complex in central and western New York and adjacent northern portions of Pennsylvania. To the west it is found on the Niagara Peninsula of Ontario, and a very similar form, called the "Dustin point," is well represented in the Lower Peninsula of Michigan. (Data received from, and specimens seen through the courtesy of Lewis R. Binford, Museum of Anthropology, University

of Michigan.) East of the Lamoka culture area it is present in eastern and southeastern New York and it has a still broader random distribution.

References: Ritchie, 1932, pp. 91-92; 1936, pp. 4-5; 1944, p. 329; 1945, p. 30; 1958, pp. 14, 31-33, 45-46, 60-61; 1959, pp. 84-85, 87-89; Dragoo, 1959, p. 238. (Ritchie has referred, in the later references, to two types, viz., Lamoka Side-Notched and Lamoka Stemmed, herein described as a single type.)

Remarks: Lamoka points seem usually to have been made from local materials, principally flints, quartz or quartzite. A pebble industry was indicated at the Lamoka Lake site. The chipping is generally coarse and marginal retouching is rare. Binford has distinguished two methods of making these points, the more common being lamellar chipping from either edge to produce a medially ridged blade. This is the only method reported by him for the "Dustin" points from Michigan.

The second method has resulted in flatter, randomly placed flaking scars, and a biconvex rather than a rhomboidal cross section for the blade. He regards this distinction as of possible chronological significance. (By conversation of November 1959.) Should his hypothesis be sustained, the writer suggests use of the terms Lamoka B and Lamoka A, respectively, for these groups.

It would seem that Lamoka points constitute a relatively early Archaic horizon style in the New York area.

LEVANNA POINTS (plate 15)



General description: Medium to large, fairly thin, triangular points, generally with concave bases.

Size: In the sample of 250 New York points used in this study, the length range was $\frac{7}{8}$ to 3 inches. The majority measured between $1\frac{1}{4}$ and $1\frac{3}{4}$ inches in length and $\frac{3}{16}$ of an inch in maximum thickness.

Proportions: Characteristically these points are nearly as broad as they are long. In the more slender examples the length varies from about one and one-third to one and one-half times the breadth.

Shape: Approximately 70 percent are equilaterally triangular. The rest may best be described as broad isosceles triangles. Edges usually straight, occasionally incurvate, recurvate, or slightly excurvate. More than 80 percent have a basal concavity, often to a marked degree, nearly V-shaped in a few examples, producing prominent corner barbs, which are occasionally asymmetric (plate 15, figures 5 and 10). The remainder have straight bases.

Age and cultural affiliations: In New York State this type evidently made its appearance in late Middle Woodland times around A.D. 700. It did not, however, become common until the transitional period into Late Woodland, ca. A.D. 900. Thereafter its popularity rapidly increased, until it became the principal Late Woodland point type over much of the area. Around A.D. 1350 it began to be supplanted by the Madison type, mainly in the districts of Iroquois cultural domination.

The Levanna point is associated as a minor type with the middle and late Point Peninsula complexes. It is the characteristic type of the Owasco of all stages of development. On the same time level as Owasco it is an important type in the Bowmans Brook, Clasons Point and Sebonac cultures of coastal New York. It appears in significant proportions in various late prehistoric manifestations of southern New England, New Jersey and Pennsylvania.

Distribution: New York, much of New England, southeastern Ontario, the Middle Atlantic area, at least to Virginia, and eastern Pennsylvania.

References: Named from the Levanna site, Cayuga County, N. Y. (Ritchie, 1928).

Remarks: Unquestionably an arrowpoint. Very finely chipped by pressure flaking. Materials local flints, jasper, quartz and quartzite.

MADISON POINTS (plate 16)



This point type was described by Scully as the Mississippi Triangular Point, later changed by him to the Madison Point (Scully, 1951, p. 14. The copy received from him contains the penciled nominal revision). He gives the association as "Middle Mississippi," and the distribution as "Middle and Upper Mississippi sites in Illinois, Wisconsin and Missouri."

Kneberg refers to a very similar point as the "Late Mississippi Triangular," but confines it to a form with "straight basal edge" (Kneberg, 1956, p. 24). She relates it to "most of the late Mississippi cultures in Tennessee," including the historic Cherokee, of the period of approximately A.D. 1300–1800. Her "Hamilton Incurvate" type, assigned to several cultures of the Late Woodland period, dating from c. A.D. 500–1000, exhibits the incurvate edges and base found on some of the points included in Scully's description as variants of the Madison type. (Kneberg, *ibid.*)

Suhm, Krieger and Jelks (1954, pp. 504, 498, 506) have defined various triangular types—the Maud, Fresno and Starr—which have features overlapping with the Madison type. These belong to assemblages which flourished during the latter half of the Christian era, and included pottery and agriculture.

The New York specimens herein described have some definite similarities to all of these possibly interrelated types. Since, however, the variations noted in our sample are readily accommodated within the compass of Scully's Madison type this name has been applied.

General description: Small, thin, triangular points.

Size: According to Scully, the length range is from $\frac{1}{2}$ to $2\frac{3}{8}$ inches, with an average of 1 inch. A New York sample of 100 points from a single prehistoric Iroquois site in western New York (plate 16) ranged from $\frac{3}{4}$ to $1\frac{9}{16}$ of an inch, with a majority falling between 1 and $1\frac{1}{4}$ inches. The thickness varied from $\frac{1}{16}$ to $\frac{3}{16}$, most of the specimens measuring $\frac{1}{8}$ of an inch, maximum.

Proportions: These vary from about as long as wide in the nearly squilateral specimens to twice as long as wide in the isosceles triangles, with most of the latter around $1\frac{1}{2}$ times as long as broad.

Shape: Equilateral (20 percent) or isosceles (80 percent) in outline, with straight (47 percent) or concave (53 percent) base (in two examples the base is slightly convex), and straight (75 percent), slightly excurvate (17 percent), or slightly incurvate (8 percent) edges. Flat or nearly so in cross section.

Age and cultural affiliations: Late prehistoric to early historic period. Constitutes, in varying proportions, an arrowpoint type of many Middle and Upper Mississippi and Late Woodland complexes. In the Northeast it is the distinctive Iroquoian form.

Distribution: Has a wide distribution in the eastern United States and southeastern Ontario.

References: Scully, 1951, p. 14.

Remarks: Very finely chipped by pressure flaking. Among the northern Iroquois the principal material employed was Onondaga flint from the exposures of central New York and the Ontario Peninsula.

MEADOWOOD POINTS (plate 17)



General description: Very thin, medium to large, side-notched points, of medium breadth.

Size: In length these points range from about $1\frac{5}{8}$ to $3\frac{1}{2}$ inches, with the majority falling between $2\frac{1}{4}$ and $2\frac{3}{4}$ inches. The thickness, even of the largest points, rarely exceeds $\frac{3}{16}$ of an inch.

Proportions: The length averages approximately two and a half to three times the breadth.

Shape: Blade trianguloid in outline, flat in cross section; edges are straight, slightly excurvate or incurvate, and are occasionally serrated or steeply beveled from opposite sides. Stem neatly side-notched, sometimes with double notch. Base straight or convex, sometimes expanded in fan shape, or beveled to scraper edge. In about 50 percent base is ground smooth.

Age and cultural affiliations: This is the characteristic point type of the early Point Peninsula (Point Peninsula 1) complex, radiocarbon dated between about 2448 B.C. (C-794, Libby, 1954, p. 137) and 563 B.C. (M-640, Crane and Griffin, 1959, p. 183). It is apparently diagnostic for this Early Woodland culture.

Distribution: Northern, central and western New York and westward across the Niagara Peninsula of southeastern Ontario. Sporadically found in eastern and southern New York, and in the upper Allegheny Valley of western Pennsylvania.

References: Ritchie, 1944, pp. 122, 125-126, 152-160; 1955, pp. 48-49, where they are termed "thin side-notched" points; 1958, p. 68, where the type is referred to as "Meadowood Side-Notched."

Remarks: While most specimens appear to be projectile points, others seem to have been made or modified for use as side or end scrapers, knives, and perhaps saws. Many could have been manufactured by

slight alteration from the numerous mortuary or "cache" blades found in burials of this culture. The flat, well-controlled pressure flaking, shows great skill. Wherever found, these points (and the accompanying mortuary blades, drills and scrapers) are prevailingly of the peculiar mottled gray and brown flint of the Onondaga exposures in western New York and the Ontario Peninsula, or of the clear gray flints of the central New York Onondaga escarpment.

NORMANSKILL POINTS (plate 18)



General description: Slender, thick points of medium size, with prominent side notches.

Size: Length range from about $1\frac{7}{16}$ to $2\frac{3}{4}$ inches, majority fall between $1\frac{5}{8}$ and 2 inches. Thickness from $\frac{3}{16}$ to $\frac{3}{8}$ of an inch, in the majority the maximum thickness is $\frac{1}{4}$ of an inch.

Proportions: Two to three times as long as wide.

Shape: Blade narrow and triangular in outline, markedly biconvex in cross section; edges straight. Stem boldly side-notched and slightly thinned by coarse flaking from the base. Base straight or very slightly concave. Rarely the base shows a little smoothing.

Age and cultural affiliations: Occurs in varying proportions on sites or site components of Middle Archaic age. Constitutes an element of the Vosburg complex, Laurentian tradition.

Distribution: Eastern New York, chiefly along the Hudson River and tributary streams, such as the Normanskill, Mohawk River and Hoosic River, from about Glens Falls to Kingston. Excavated from the Harris site (Scv 1-2), Saratoga County, and from Stratum 3 of the Lotus Point site (Ctl 3-1), Greene County. The dominant point form on the river site (Coh 8-3), Saratoga County. Abundant on the Vosburg site, Albany County.

References: Ritchie, 1958, pp. 8-53, plate 3, figures 23-33; plate 12, figures 9, 10; plate 15, figures 11-58, where they are described as "narrow side-notched points."

Remarks: This point suggests a slender variant of the Brewerton Side-Notched type which, described as "broad side-notched" by the writer (1958), occurs with it on the aforementioned eastern and other New York sites. Morphologically it is transitional between the Lamoka side-notched and Brewerton side-notched forms.

The materials used are local flints. The techniques employed in fabrication seem for the most part to have been percussion for the rough shaping of the point and pressure flaking to produce the varying amounts of marginal retouching.

ORIENT FISHTAIL POINTS (plate 19)



General description: A slender, gracefully formed point, of medium size, with characteristically narrow, lanceolate blade merging into a flaring "fishtail" stem.

Size: Length range from about $1\frac{3}{16}$ to 4 inches, predominantly 2 to $2\frac{1}{2}$ inches. Maximum thickness $\frac{3}{16}$ to $\frac{7}{16}$ of an inch, majority fall between $\frac{1}{4}$ and $\frac{5}{16}$ of an inch.

Proportions: These points are two and one-half to three and one-half times as long as wide.

Shape: Blade lanceolate in outline, biconvex to nearly flat in cross section; edges excurvate. Sloping shoulders merge into flaring stem with incurvate or less often, straight base. Latter occasionally slightly smoothed.

Age and cultural affiliations: Late Archaic and Transition period into Early Wood-

land. The characteristic point type of the Orient complex on Long Island and of a related manifestation with stone vessels in the Hudson Valley and elsewhere. Orient complex radiocarbon dated between 1044 B.C. $\pm$ 300 years (M-586) (Crane and Griffin, 1958, p. 1101) and 763 B.C. $\pm$ 220 years (W-543). (Ritchie, 1959, pp. 47-49, 74-76.)

Distribution: Eastern and southern New York, particularly the middle and lower Hudson Valley and Long Island. Has a light, sporadic representation in central New York, southern New England and northern and central New Jersey.

References: Ritchie, 1944, p. 227 ff.; 1958, esp. pp. 29-31, on the stratigraphic position of these points on a Hudson Valley site; 1959, on the Orient complex. Formal description under same name in latter, pp. 31-32.

Remarks: In the Orient complex of Long Island, a majority of these points were made, apparently by indirect percussion, from the local quartz or quartzite pebbles. Elsewhere regional flints of good quality or occasionally jasper or even slate were employed, and the flat flaking scars suggest reduction from a thick spall by a pressure technique.

OTTER CREEK POINTS (plates 20, 21, 22)



General description: Large, thick, narrow or medium wide, side-notched points, with "square" tangs.

Size: Length range from about $2\frac{1}{4}$ to $4\frac{1}{2}$ inches, majority fall between $2\frac{3}{4}$ and $3\frac{1}{2}$ inches. A few probable spearpoints of larger size have been identified (plate 22). Thickness range $\frac{5}{16}$ to $\frac{1}{2}$ inch, majority measure between $\frac{5}{16}$ and $\frac{7}{16}$ of an inch.

Proportions: Two to three times as long as wide.

Shape: Blade ovoid or lanceolate, rarely trianguloid in outline, biconvex in cross section; edges excurvate, less often straight; stem side-notched, notching seems to have been final operation, resulting in "square" tangs. Base concave or less frequently straight. Almost invariably the base and tang edges have been ground or rubbed smooth, and in nearly all cases this treatment has been extended to the notch.

Age and cultural affiliations: The prevailing point type of certain, still undescribed sites, apparently to be attributed to the poorly defined Vergennes complex of the Archaic Laurentian manifestation in western Vermont (Ritchie, 1944, pp. 253-257).

Distribution: As currently known, west central Vermont, especially the valley of Otter Creek and its tributaries. The predominant point form on certain sites explored by Thomas E. Daniels, Orwell, Vt. (plate 20); present also on the multicomplex Vergennes site (Bailey, 1939) and several other stations in this area. A cross tie with the Brewerton complex in central New York is afforded by the occurrence of a few points of this type on the Robinson site (Ritchie, 1940, plate 13, figure 97) and, conversely, of Brewerton type side-notched, corner-notched and eared-notched types on the Vermont sites in question.

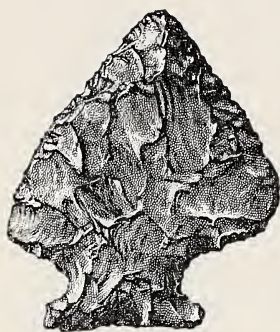
NEW YORK PROJECTILE POINTS

An occasional point of this type is found on Archaic sites in eastern New York (plate 21).

References: None.

Remarks: The author believes the Otter Creek point is genetically related to the Brewerton Side-Notched point and to other similar types mentioned under the description of the latter (page 72). Side-notched points apparently very like Otter Creek points are reported from levels 5 and 6 of the Graham Cave site in Missouri (Logan, 1952, plate V, G-L; plate VI, A, B), and from the Osceola site of the Old Copper culture in Wisconsin (Ritzenthaler, 1946, plate 6; Bell, 1958, p. 68). Because of its large size it may have been primarily a spearpoint. The material of many of these points is a regional quartzite or metamorphosed siltstone or slate. Some, however, are of native or probably eastern New York flints. The chipping seems to have been done by percussion with secondary marginal pressure flaking on most examples.

PERKIOMEN BROAD POINTS (plate 23)



Witthoft is responsible for the definition of this type which he has termed the "Perkiomen Broad Spearpoint." The following discussion is based largely on his paper, cited below.

General description: "Very broad, boldly flaked spearpoints of semi-lozenge shape, with certain characteristic contour details often exaggerated."

Size: "Rarely less than two inches long and rarely more than four. Specimens up to nine inches long are sometimes found, and I have seen some examples four inches broad and six long."

A small New York sample ranged between $\frac{1}{4}$ and $\frac{5}{16}$ of an inch in thickness, with most examples in the lower range. The average thickness of this type slightly exceeds that of the Susquehanna Broad type.

Proportions: "Generally half as broad as long, or more. Rarely narrow, often very asymmetrical."

Shape: "Blade: Generally approximates an equilateral triangle, with convex edges near tip, and often slight convexity or concavity elsewhere. Blade edges are frequently asymmetrical, and the blade is often somewhat out of center in relation to the tang. Blades are thin, with rarely any medial ridge; where one occurs on one face, the other face is usually flat.

"Ears [Shoulders]: Frequently barbed, sometimes at both ears but more often only at one corner. The ears may form either obtuse or acute angles, but even strongly barbed specimens rarely have very acute ears. Edges in the ear area are always thin and sharp, and were carefully retouched to straight, even edges. Often the blade edge ahead of the ear is somewhat concave or convex. Chipping details of the ears and of the blade are like those of the Susquehanna Broad Spearpoint, but the breaks in contour of the edge are frequently very pronounced in the Perkiomen type, and the barbs and grotesquely turned corners are exaggerations of these shape details. The two edges of a specimen rarely show strong symmetry.

“Tang [Stem]: Always constricted and almost invariably with a convex base; the base is sometimes straight but is almost never concave. [In about half of the New York specimens the base is straight.] The tang is unusually small compared with the blade, and frequently is tiny in proportion to the rest of the spear. The tang corners are rounded, not prominent, and never suggest barbs. All edges of the tang are always ground smooth, including the basal corners of the tang. [This does not apply to many of the New York specimens.] This edge grinding extends out onto the ears only a short distance, generally to a conspicuous break in outline.”

Age and cultural affiliations: Probably like the Susquehanna Broad point, i.e., of the Transitional period from Late Archaic into Early Woodland. Witthoft has hypothesized that “The Susquehanna Broad Spear type appears to be the ancestor of the Perkiomen Broad Spear and the Lehigh Broad Spear [probably related to the Snook Kill point, herein described, see pp. 47-48] types, . . . as well as of slightly different broad types of central New York and of the Hudson-Mohawk. . . . These derived types are, I believe, both later than and contemporary with the Susquehanna Broad Spear type; at any rate, they are overlapping ages and there do not seem to be any very significant time differences among them. Distributions are more geographic than temporal.” (Witthoft, 1953, p. 16.)

Distribution: The Schuylkill Valley and its tributary streams entering from the north, the eastern borders of the Susquehanna Valley, the Delaware and Hudson Valleys. Sporadically distributed in northern and central New Jersey and in the Mohawk, Seneca, and Genesee Valleys of New York.

References: Witthoft, 1953, pp. 16-20.

Remarks: The commonest lithic material of these points is Pennsylvania jasper, usually of the finest grades. Other specimens are of rhyolite; Onondaga flint from central and western New York; Deepkill and Normanskill flint from the Hudson Valley; Flint Ridge, Ohio chalcedony; and rarely, argillite or quartzite.

POPLAR ISLAND POINTS (plates 24 and 25)

This description was prepared by W. Fred Kinsey III.

General description: Medium to large, finely flaked, symmetrical points, having quite slender isosceles triangular blades. Shoulders are rounded and the constricted stem tapers toward a narrow rounded base.

Size: They range from 1.8 inches to 3.4 inches with the average length slightly over 2 inches. In cross section they are usually oval with some examples rather thin and flat.

Proportions: Generally they are more slender than Bare Island points. Blade width in comparison to length is narrow except where some specimens have rechipped blades.

Shape: Blade exhibits considerable symmetry in the form of a slender isosceles triangle. Edges are nearly straight with only a slight trace of convexity. Tips and edges are crisp and the tip is always on center with the stem. There is no medial ridge.

Shoulder area always rounded and on some specimens the shoulder is not clearly defined. Usually it is a graceful curve and some pieces lack distinct shoulders.

The nonparallel sides of the stem taper toward the base which is the narrowest part of the stem. The lobate base is always convex and sometimes it is nearly pointed. Basal corners are always round and never sharp. Edge grinding is frequently present.

Age and cultural affiliations: This is the second most popular point type excavated at the Kent-Hally site on Bare Island. It occurs with an overall frequency of 20 percent and its distribution was remarkably uniform in all levels. At Kent-Hally two of this type were found in intimate association with stone pots. One was inside a broken steatite bowl and the other was lying against the outside wall of the vessel (Kinsey 1959, pp. 128-129). The writer therefore suggested that this was a Late Archaic type contemporaneous with the utilization of steatite bowls, and also that the use of steatite might have been early in the lower Susquehanna since the quarries are nearby. Witthoft, to the contrary, places these points earlier in the Archaic since they are found in deeper levels on Duncan's Island. He believes the Poplar Island and Bare Island points are close contemporaries. Probably their antecedents lie in the Virginia and Carolina Piedmont and on the Savannah River in Georgia.

Distribution: The type is found in the same general area as the Bare Island point but with a lower frequency. It is particularly conspicuous on Poplar Island and Duncan's Island in the lower Susquehanna River. It also occurs along the Chesapeake and at the Accokeek Creek site.

[It has a sporadic distribution northward across Delaware and New Jersey into southern and eastern New York. (See plate 25.) W.A.R.]

References: Kinsey, 1959, p. 115, where it is referred to as "tapered or lobate-stemmed, Type C;" Witthoft, 1959, p. 83.

Remarks: At the Kent-Hally site 37.7 percent of these points are of siltstone, 24.5 percent of argillite, and 20 percent of quartz. Others are made of quartzite, rhyolite and flint. At Poplar Island and Duncan's Island the use of siltstone and argillite is also conspicuous.

ROSSVILLE POINTS (plate 26)



General description: Thick, lozenge-shaped points of medium size.

Size: Length range approximately $1\frac{1}{4}$ to $2\frac{1}{2}$ inches; majority fall between $1\frac{3}{4}$ to 2 inches. Maximum thickness varies from $\frac{1}{4}$ to $\frac{7}{16}$ of an inch in a sample of 72 from New York, with most of the specimens measuring $\frac{5}{16}$ of an inch.

Proportions: About twice as long as wide.

Shape: Roughly rhomboidal or lozenge-shaped. Some examples have weak, oblique shoulders which merge with a contracting stem terminating in a blunt point. Edges are straight or slightly excurvate.

Age and cultural affiliations: Very late Archaic, Transitional and Early Woodland periods. They occur in the lower levels of certain coastal New York shell heaps, apparently without pottery associations, and continue into the North Beach and Clearview ceramic foci. It is probable that they constitute a point type of other foci as well.

Distribution: From the Chesapeake Bay area, where it may have originated, northward through southern and southeastern New York and southern New England.

References: Skinner, 1915, p. 57; 1919, p. 70; Smith, 1950, pp. 134, 135; Holland, 1955, p. 170 (termed "Type K-Contracting Stem"); Ritchie, 1958, p. 74, figures 25, 26 (termed "lozenge-shaped points").

Remarks: Named from an early reference by Skinner to their predominance at the Rossville site on Staten Island, N. Y. (Skinner, 1915, p. 57). There seem to be no data to sustain the high antiquity accorded to this form by Skinner.

Materials are chiefly quartz and argillite in the southern part of their range, quartz and felsite in Connecticut and Massachusetts, and flint in the Hudson Valley. These points display some overlap in shape with the Poplar Island type, and a genetic relationship seems probable.

SNOOK KILL POINTS (plate 27)



General description: Very broad, large, thick, contracted stemmed points.

Size: Length range is from about 2 to 4 inches, with the majority falling between $2\frac{1}{4}$ and $3\frac{1}{2}$ inches. Thickness ranges from $\frac{1}{4}$ to $\frac{9}{16}$ of an inch; most points measure between $\frac{5}{16}$ and $\frac{7}{16}$ of an inch.

Proportions: Typically about one and one-half times as long as broad.

Shape: Blade trianguloid in outline, bi-convex or plano-convex in cross section; edges straight, slightly to moderately ex-curved, or slightly incurvate. Stem contracted or straight. Shoulders pronounced and often asymmetric. No true barbs. Base straight or slightly lobate. A very small percentage have slight to moderate basal grinding.



Age and cultural affiliations: The type overlaps with the Lehigh Broad Spear-point of Witthoft (1953, pp. 21-22), and is probably of comparable age. The author believes the Snook Kill complex will prove to be related to the even less well understood Late Archaic complex in eastern Pennsylvania to which the Lehigh point belongs. There is also enough general similarity between Snook Kill and Savannah River points to suggest a genetic relationship.

Distribution: Eastern New York, especially the Hudson Valley between Albany and Glens Falls and the lower Hoosic Valley.

References: Ritchie, 1958, pp. 91-98.

Remarks: Nearly every specimen is made of eastern New York flints, Normanskill,

Deepkill, Fort Ann; a few are of Onondaga or Oriskany flint, or of weathered argillite, probably from the Delaware Valley in New Jersey or eastern Pennsylvania, from which area the author suspects this complex entered New York.

The points exhibit broad, shallow flaking scars indicative of percussion chipping. In a fair number of cases retouching from both sides has resulted in relatively thin, sharp, straight or slightly sinuous edges.

Snook Kill points were probably employed on darts and spears. Some with markedly convex edges (plate 27, figures 2 and 3), and especially the variant with asymmetric edges and almost lozenge-shaped base, were doubtless knives.

SNYDERS POINTS (plate 28)

The following description is based upon Scully (1951) and Bell (1958).

General description: A large, broad, ovate point with deep corner notches.

Size: The length range is from about 2 to 6 inches, the majority falling between $2\frac{1}{2}$ and 3 inches.

Proportions: About four-fifths as wide as it is long.

Shape: Blade broad and ovate in outline, relatively thin and nearly flat in cross section, edges excurvate. Stem short, deeply and usually broadly corner-notched, and basally expanding. Base markedly convex.

Age and cultural affiliations: It is a characteristic form of the Hopewellian culture of Middle Woodland age (approximately 500 B.C. to A.D. 500).

Distribution: Central and northern Illinois, southwestern Michigan, eastern Missouri, northeastern Oklahoma, the central Mississippi Valley, the middle and upper Ohio Valley, and elsewhere, including western New York.

References: Scully, 1951, p. 12; Bell, 1958, pp. 88-89.

Remarks: Of rare occurrence in New York, where its distribution coincides with that of Hopewellian burial mounds. Most New York examples are made of Harrison County, Indiana or Flint Ridge, Ohio materials.

STEUBENVILLE LANCEOLATE POINTS (plate 29)



General description: Rather broad, lanceolate points, of medium to large size, with slightly concave bases.

Size: Length range from about 1 to $3\frac{3}{16}$ inches; the majority measuring between 2 and 3 inches. Thickness (of the small sample from New York State) $\frac{5}{16}$ to $\frac{3}{8}$ of an inch.

Proportions: These points are two to two and one-half times as long as wide.

Shape: Lanceolate, with excurve or slightly recurvate edges. Biconvex in cross section. Base usually mildly to moderately constricted and slightly concave. No smoothing, but occasional thinning present in the New York sample.

Age and cultural affiliations: Problematical in the New York area. Found in the Panhandle Archaic of West Virginia in association with the Steubenville Stemmed type.

In eastern and southern New York State, where a similar point association occurs, early pottery styles are evidently also present.

See fuller data under Steubenville Stemmed type, pp. 51, 52.

Distribution: The West Virginia Panhandle area and elsewhere in the upper Ohio Valley; central New York, especially in the upper Susquehanna Valley region; eastern New York, particularly in the Hudson Valley south from Greene and Columbia Counties; Staten Island, Long Island, and the upper Delaware Valley in New Jersey, Pennsylvania and New York.

References: The Steubenville Lanceolate and Stemmed points were named, but not defined or formally described, by Mayer-Oakes, 1955, pp. 130-142; 1955a, pp. 8, 17-20; Ritchie, 1958, p. 99.

Remarks: These points are generally made of regional flints. In the lower Hudson and upper Delaware River regions, however, a purple or gray-weathering black argillite predominates.

STEUBENVILLE STEMMED POINTS (plate 30)



General description: Broad, heavy points of medium to large size, with wide stems and very weak shoulders.

Size: In the sample of about 50 New York points studied, the length ranged from $1\frac{3}{4}$ to $3\frac{1}{2}$ inches, with the majority measuring between 2 and $2\frac{1}{2}$ inches. The thickness varied from $\frac{1}{4}$ to $\frac{7}{16}$ of an inch, most examples falling into the narrow range between $\frac{5}{16}$ and $\frac{3}{8}$ of an inch.

Proportions: From about one and one-fourth to two and one-half times as long as wide, with most of the points closer to the former proportions, giving them a short, wide, "stubby" appearance.

Shape: Blade outline ovate, lanceolate or trianguloid in descending order of frequency; mildly biconvex in cross section; edges excurvate. Stem wide, with very small, right angular or sloping (obtuse angular) shoulders. In many cases the shoulders are so weakly developed as to be almost nonexistent, and such intergrades link the stemmed and lanceolate forms. Base concave or less often straight. Very slight smoothing of the basal and/or stem edges, apparently more from use than design, occurs on a small proportion of the specimens. In a few of the specimens the base has been thinned by the removal from one side of the stem of one or more shallow vertical channel flakes.

Age and cultural affiliations: Currently unknown in the New York area. Part of the Panhandle Archaic of West Virginia. Mayer-Oakes regards this and the culturally related Steubenville Lanceolate form as very early Archaic in the upper Ohio Valley. He makes the assumption that "They were derived from the late Paleo-Indian 'Scottsbluff' and 'Starved Rock Lanceolate' types, which came into the area from the west at about the time of the post-glacial climatic maximum." (Mayer-Oakes, 1955a, p. 20.) Dragoo, on the other hand, would place the Steubenville types in the Late Archaic complexes of the upper Ohio Valley (Dragoo, 1959, pp. 202-206, 210, 213).

In eastern and southern New York State there is some evidence that these types have ceramic associations. On the Ford site (Ct. 16-2),

Columbia County, they have been found on the same level with net-impressed, grit-tempered, or shell-tempered and leached pottery.

"At Pelham Boulder [Har. 4-4, Bronx County], the Steubenvilles were in or near sherd clusters in the bottom third of the midden; collectively the types are Vinette 1, Modified Vinette 1, Fabric Impressed, Net Impressed, Exterior Cord marked (like Vinette 1 and Modified Vinette 1 except that there are no interior cordmarks) and Abbott Zoned Dentate." (Julius Lopez, letter of January 3, 1960; cf. Lopez, 1956, p. 15.)

Distribution: The upper Ohio Valley, especially the West Virginia Panhandle area; central New York, particularly the Susquehanna Valley around Colliersville, Otsego County, and sporadically down river at least to Susquehanna, Pennsylvania; eastern New York, chiefly the Hudson Valley from Greene and Columbia Counties southward to the mouth of the river; Staten Island; western Long Island; the upper Delaware Valley in New Jersey, Pennsylvania and New York.

No doubt, as this point type becomes more generally recognized, the range will be considerably extended, at least to include some of the intervening areas.

References: The Steubenville Stemmed and Lanceolate types were named, but not defined or formally described, by Mayer-Oakes, 1955, pp. 130-142; 1955a, pp. 8, 17-20; Ritchie, 1958, p. 99.

Remarks: In most areas, local materials seem to predominate in the composition of these points. In central and eastern New York, however, a small percentage is comprised of purple- or gray-weathering argillite, presumably derived from the Delaware Valley of New Jersey. The incidence of argillite as a material rises sharply in the lower Hudson and Delaware Valleys.

SUSQUEHANNA BROAD POINTS (plate 31)



This point type has been described by John Witthoft of the Pennsylvania State Museum as the Susquehanna Broad Spearpoint. The following discussion is taken very largely from his work, cited below, as it applies with equal validity to the New York material in my sample of several hundred points.

General description: "Broad, boldly flaked spearpoints of roughly semi-lozenge to rough corner-notched shape, with certain characteristic contour details."

Size: "Most specimens are between an inch and a half and four inches long; rare examples are as short as an inch and as long as eight inches."

The thickness of a representative sample of New York points varied between $\frac{3}{16}$ and $\frac{3}{8}$ of an inch.

Proportions: "Generally half as broad as long, or less. Rarely quite narrow."

Shape: "Blade: Triangular, usually with some portion of the edges convex, especially near tip. Edge often somewhat concave near base. Frequently not symmetrical. In cross section, the faces of the blade are evenly rounded rather than keeled or flat. Retouching of the edge to final contour was usually from one face of the blade.

"Ears [Shoulders]: Not barbed, but jutting in a characteristic fashion. The ears are usually angular, forming an obtuse angle, and are sometimes somewhat rounded. In either case, they are always thin and sharp, carefully retouched to thin, straight edges.

"Tang [Stem]: Always constricted and almost always with a concave base; base is rarely straight or extremely concave. Base of the tang narrower than the ears, with tang corners generally acute and prominent. All edges of the tang are always ground smooth, including the basal corners of the tang."

Age and cultural affiliations: Transitional period linking Late Archaic and Early Woodland periods. Probably between approximately 1200 and 700 B.C. The culture complex (or complexes) to which

these points belong is poorly known, and with one exception, comes from surface sites. They form part of a widely spread steatite or soapstone pot-using culture which, in the Susquehanna Valley, has a very limited associated complex mainly comprising distinctive forms of chipped drills and scrapers, netsinkers, and crude ornaments of steatite.

Distribution: The Susquehanna Valley in Pennsylvania and New York and its principal tributaries; the Delaware drainage system north of the Water Gap; the Hudson and Mohawk Valleys; the Finger Lakes region and the Seneca River and its affluent sources, including Oneida Lake. The center of distribution seems to have been the Susquehanna Valley in Pennsylvania.

References: Witthoft, 1953, pp. 7-16.

Remarks: In Pennsylvania, nearly all points of this type are said to be made of purplish rhyolite derived from outcrops of this metamorphosed volcanic rock in Franklin and Adams Counties, near Gettysburg, Pennsylvania. This material also composes a large number of the New York specimens and, together with the frequently associated steatite, proves the intrusive nature of these artifacts, and almost certainly of the complex to which they pertain. However, a much larger proportion of the New York specimens, contrary to Witthoft's statement (op. cit. pp. 8, 12) are of the local flints, for the most part Onondaga, and constitute local copies of the introduced points.

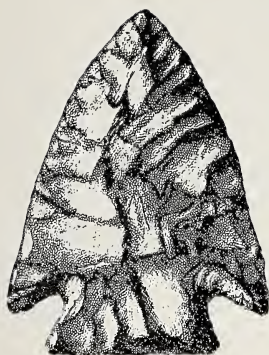
Susquehanna Broad points of rhyolite and flint, associated with steatite pot fragments, were excavated from the upper level of the Frontenac Island site, Cayuga County, N.Y., above deeper deposits of Archaic age (Ritchie, 1945).

Witthoft has classified these points as "spearpoints" but has not defined the term. The author has distinguished between spearpoints and dartpoints earlier in this study (see pages 5-6).

He suspects that the shorter examples were dartpoints. Some of the very thin and fragile specimens may well have served as knives.

The writer has attempted to show the existence, chiefly in eastern and southern New York, of intergrades connecting the Susquehanna Broad point with the Orient Fishtail point (Ritchie, 1959, pp. 90-91, 169).

VOSBURG POINTS (plate 32)



General description: Medium sized, broad, relatively thin points, with small to medium corner notches on a prevailing short stem which is basally ground smooth.

Size: The length range is from about one to $2\frac{3}{4}$ inches, the majority falling between $1\frac{1}{2}$ and 2 inches, with a maximum thickness of $\frac{3}{16}$ to $\frac{1}{4}$ of an inch. Longer points, probably spearheads, do occur, the largest seen measuring $4\frac{1}{2}$ inches long, $1\frac{1}{2}$ inches wide, and $\frac{3}{8}$ of an inch thick (plate 32, figure 11).

Proportions: Length averages about one-quarter greater than breadth in most specimens. The larger points are two to two and one-half times as long as wide.

Shape: The blade is trianguloid in outline, slightly biconvex or nearly flat in cross section; the edges are straight, mildly excurvate, or rarely incurvate. A slight degree of serration is not uncommon. The stem is corner-notched, usually with small notches forming rather weak barbs, expanded, and usually very short. The base is straight or slightly concave, and nearly always ground smooth.

Age and cultural affiliations: An important point form of the Vosburg complex, Laurentian tradition, occurring in varying proportions on nearly all sites of this manifestation. Examples were present in Level 4, or near the base of the stratified Lotus Point site in the Hudson Valley, hence they seem to have appeared rather early in the Archaic horizon of this area.

Distribution: Primarily an eastern New York form, especially in the Hudson, Mohawk and Hoosic Valleys. Of sporadic occurrence in peripheral regions. A few examples were excavated at the Robinson site of the Brewerton complex, Laurentian tradition.

References: Ritchie, 1940, p. 29; 1944, pp. 257-259; 1958, pp. 19, 32, 59, 69, 80. In the last reference the type is referred to as "Vosburg Corner-Notched."

Remarks: Generally made of eastern New York Normanskill and Deepkill flints, apparently by pressure flaking techniques.

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PLATE 1—ADENA POINTS

1-3, 5, 6, Van Orden site, Greene County, N. Y.; 4, 8, 9, Onondaga County, N. Y.; 7, Cattaraugus County, N. Y.

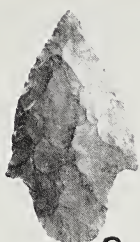
1-3, 5, 6, Carl S. Sandler collection; others N. Y. S. Mus. collection.

Material: 1, 2, Normanskill flint; 3, 5, 6, Fort Ann flint; 4, 8, Onondaga flint; 7, Harrison County, Ind. flint; 9, exotic flint.

NEW YORK PROJECTILE POINTS



1



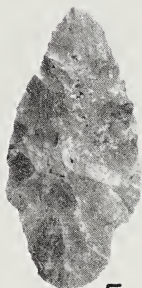
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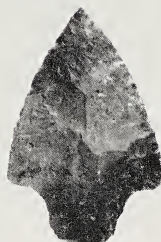
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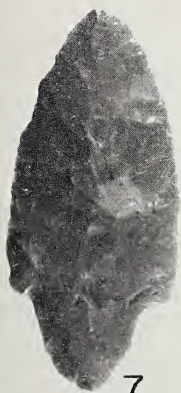
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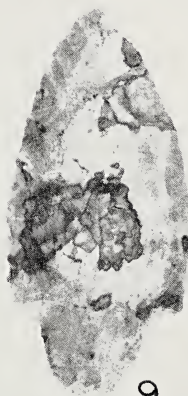
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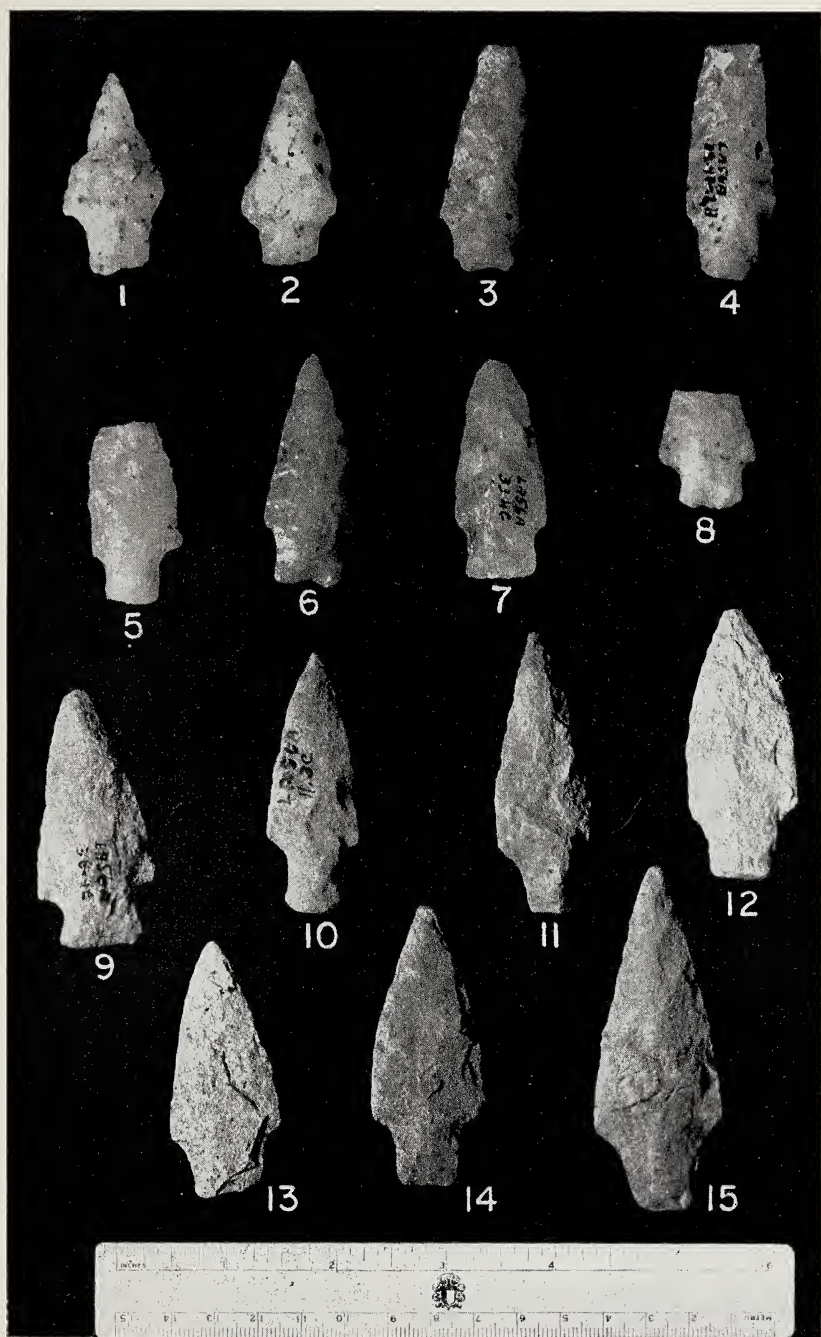
PLATE 2—BARE ISLAND POINTS

Kent-Hally site, Bare Island, Lancaster County, Pa.

Collection of Pennsylvania Historical and Museum Commission by whose courtesy they are reproduced.

Material: 1-8, quartz; 9, quartzite; 10-12, 14, 15, siltstone; 13, rhyolite.

NEW YORK PROJECTILE POINTS



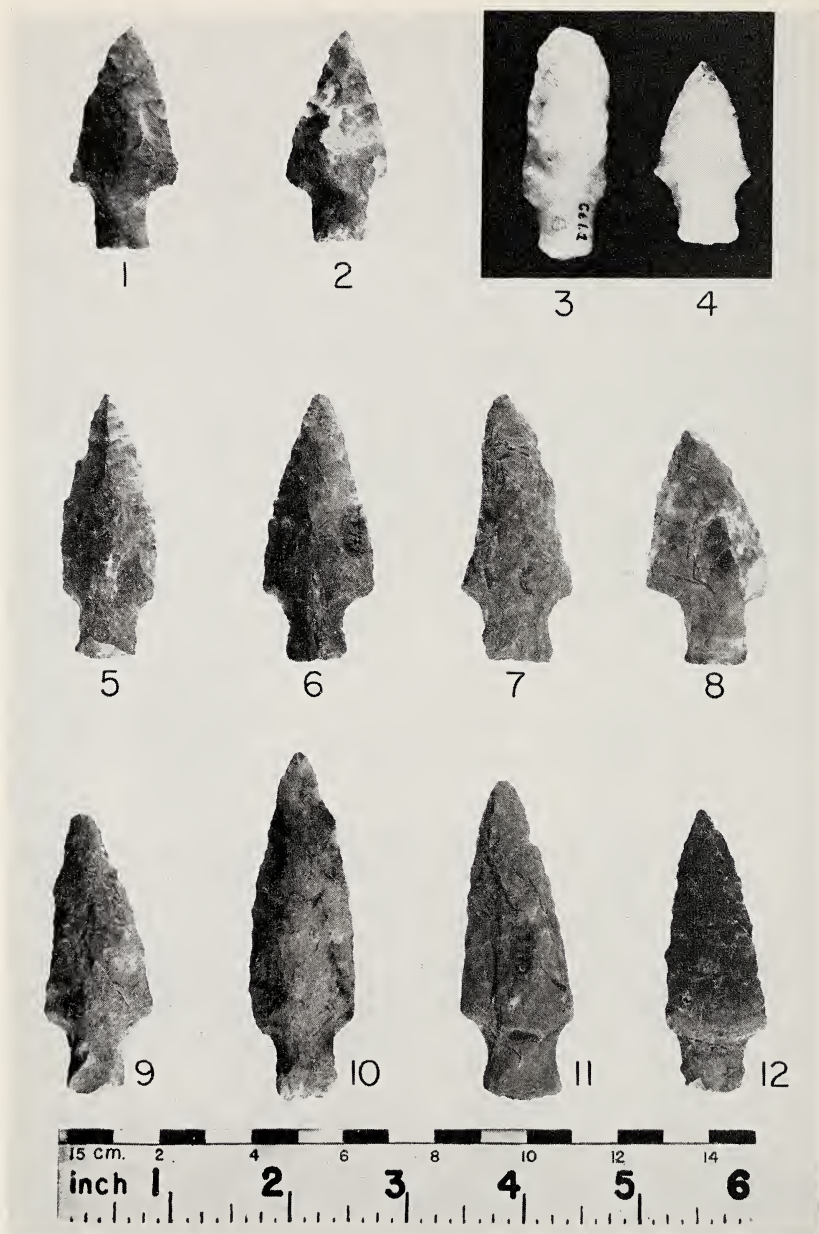


PLATE 3—BARE ISLAND POINTS

1-9, 11, 12, Van Orden site, Greene County, N. Y.; 10, Coh. 9 site, Rensselaer County, N. Y.

Collection Carl S. Sundler.

Material: 1, 2, 5, 6, 12, Deepkill flint; 3, 4, quartz; others Normanskill flint.

PLATE 4—BREWERTON CORNER-NOTCHED POINTS

1, 4, 5, 9, Oberlander No. 1 site, Brewerton, Oswego County, N. Y.; 2, 6, 10, 12, Robinson site, Brewerton, Onondaga County, N. Y.; 3, 7, 8, 11, Onondaga County, N. Y.

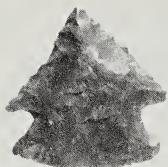
1, 2, 4-6, 9, 10, 12, collection of Rochester Museum of Arts and Sciences; others collection of N. Y. State Museum.

Material: All Onondaga flint.

NEW YORK PROJECTILE POINTS



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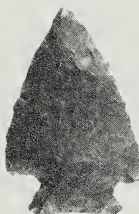
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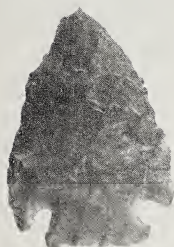
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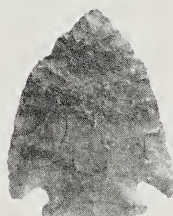
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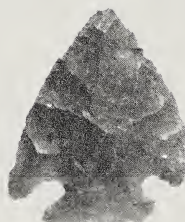
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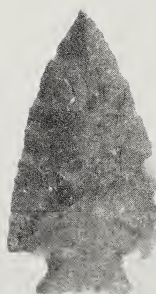
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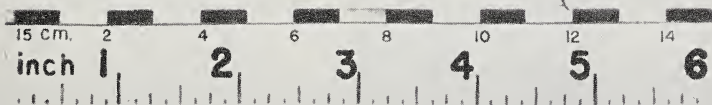


PLATE 5—BREWERTON EARED-NOTCHED POINTS

1-3, 7, 8, Onondaga County, N. Y.; 4, Coh. 9 site, Rensselaer County, N. Y.; 5, 6, Robinson site, Brewerton, Onondaga County, N. Y.; 9, Van Orden site, Greene County, N. Y.

4, 9, Carl S. Sundler collection; 5, 6, collection of Rochester Museum of Arts and Sciences; others N. Y. State Museum collection.

Material: 1-3, 5-8, Onondaga flint; 4, 9, Normanskill flint.

NEW YORK PROJECTILE POINTS

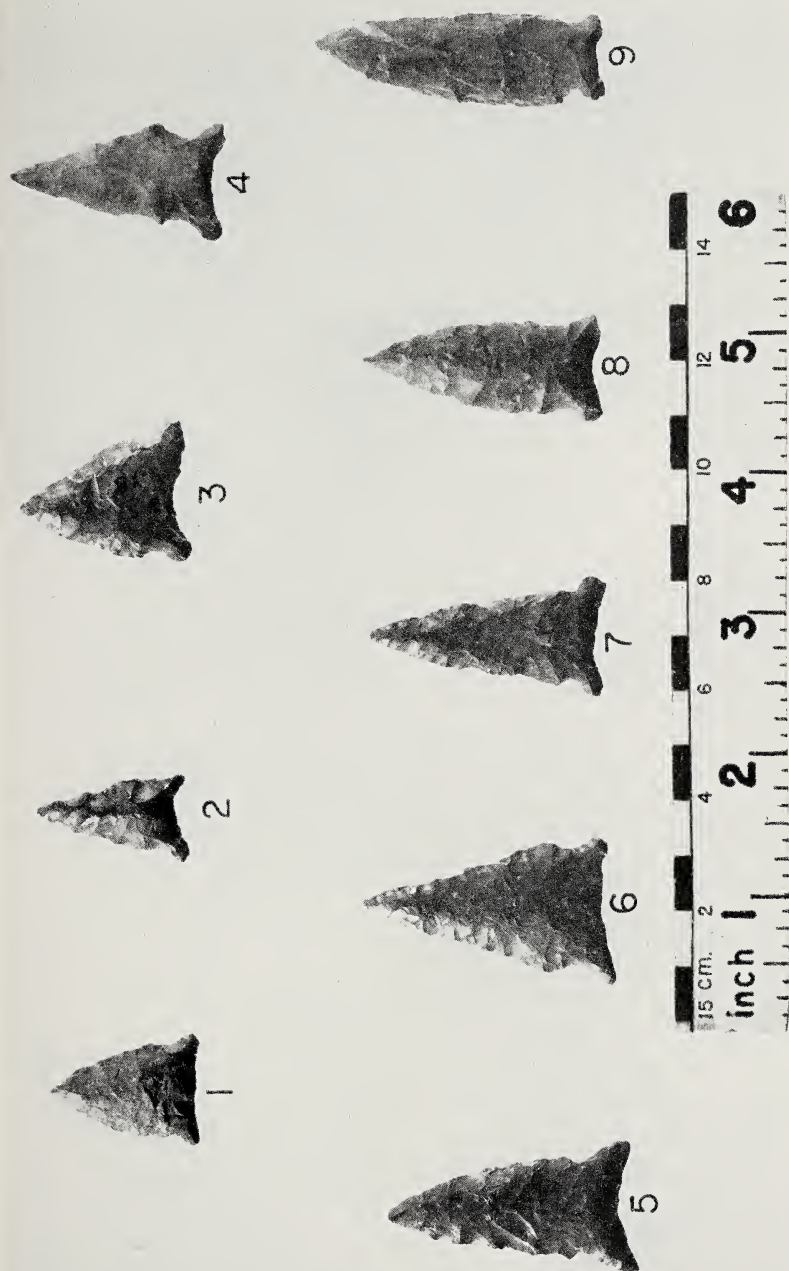
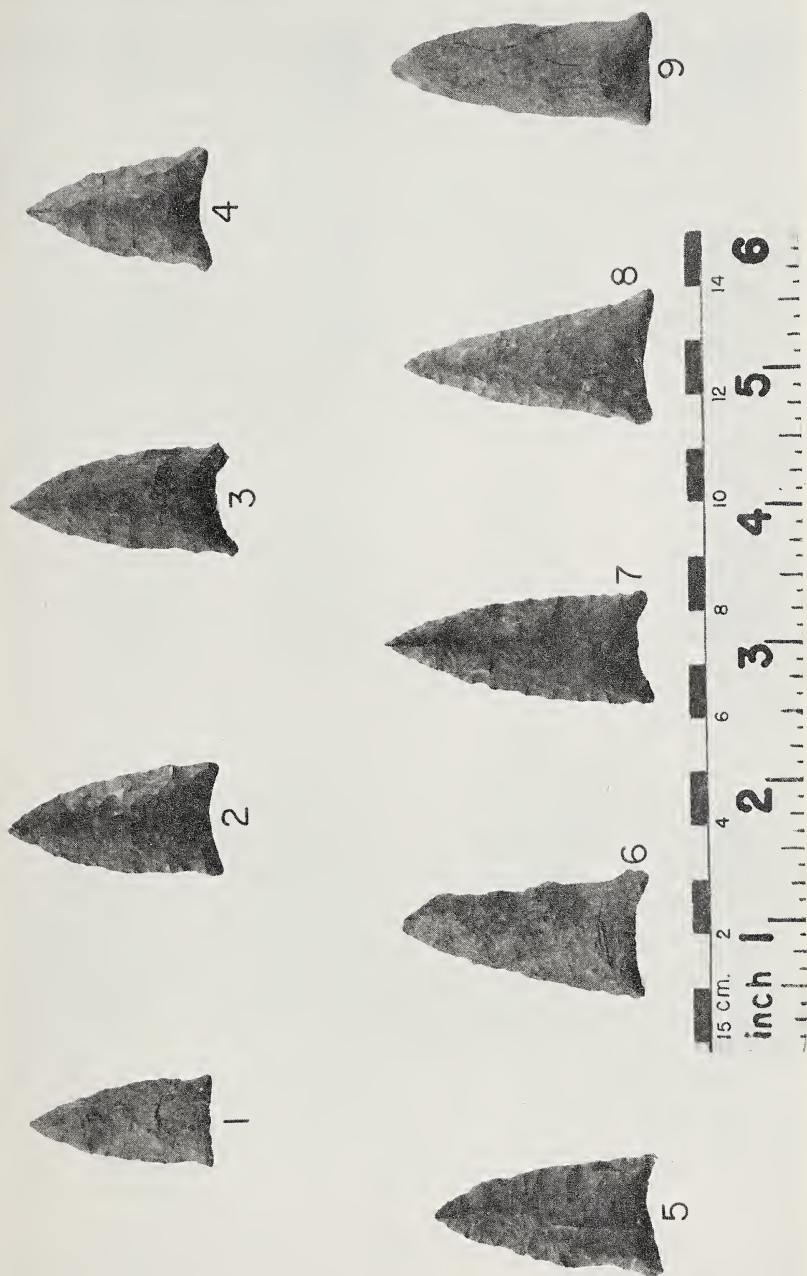


PLATE 6—BREWERTON EARED-TRIANGLE POINTS

1, 9, Coh. 9 site, Rensselaer County, N. Y.; 2-5, 7, Robinson site, Brewerton, Onondaga County, N. Y.; 6, Barren Island site, Albany County, N. Y.; 8, Onondaga County, N. Y.

1, 9, Carl S. Sundler collection; 2-5, 7, collection of Rochester Museum of Arts and Sciences; 6, R. Arthur Johnson collection; 8, N. Y. State Museum collection.

Material: 1, Deepkill flint; 2-5, 7, 8, Onondaga flint; 6, 9, Normanskill flint.



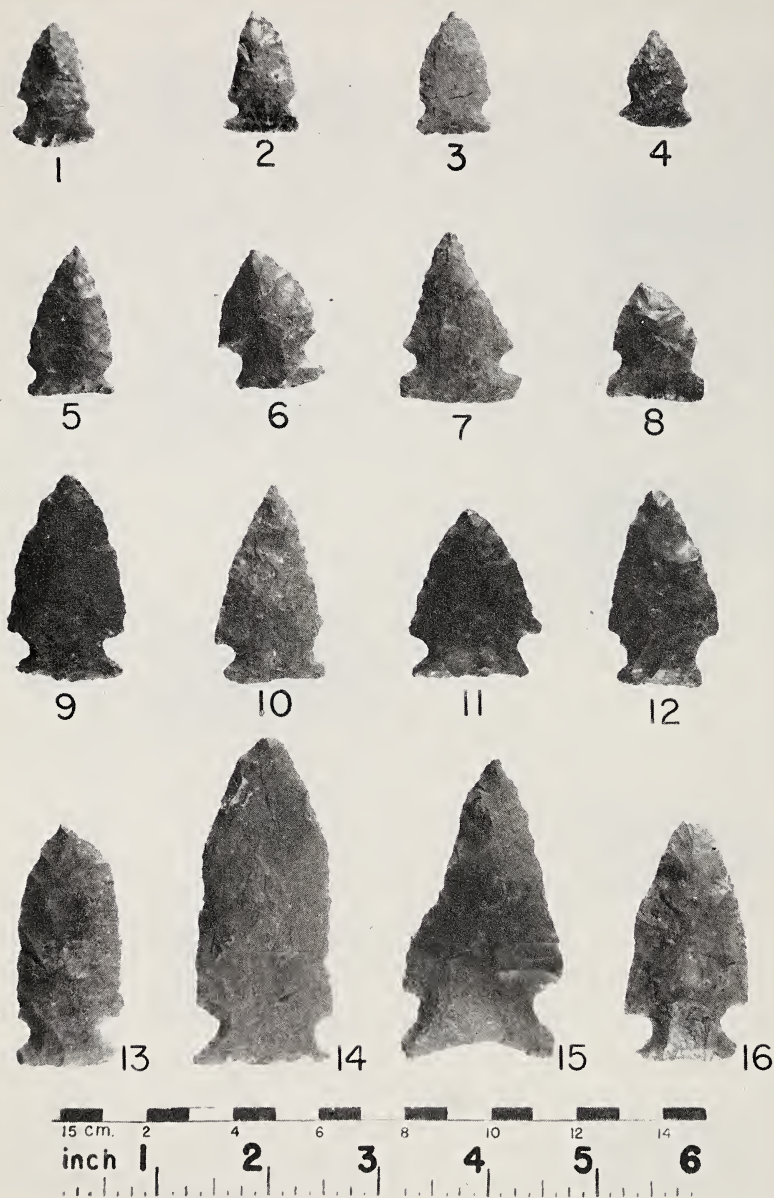


PLATE 7—BREWERTON SIDE-NOTCHED POINTS

1-5, 7-8, 13-16, Robinson site, Brewerton, Onondaga County, N. Y.; others Oberlander No. 1 site, Brewerton, Oswego County, N. Y.

All in collection of Rochester Museum of Arts and Sciences.

Material: All Onondaga flint.

PLATE 8—CLOVIS POINTS

1, Cte. 1-2 site, Deer River, Lewis County, N. Y.; 2, Onondaga County, N. Y.; 3, Kingston site No. 2, Ulster County, N. Y.; 4, 7, 8, Cocksackie, Greene County, N. Y.; 5, Livingston County, N. Y.; 6, Lot 12, Van Buren, Onondaga County, N. Y.

All in collection of N. Y. State Museum.

Material: 1, Little Falls dolomite flint; 2, 3, 5, 8, jasper; 4, Deepkill flint; 6, 7, Onondaga flint.

NEW YORK PROJECTILE POINTS



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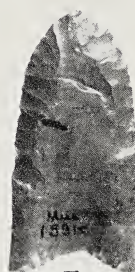
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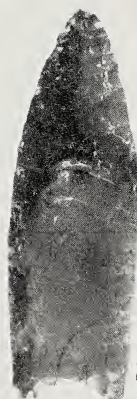
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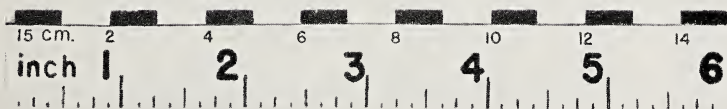




PLATE 9—FULTON TURKEY TAIL POINTS

1, Seneca River, Onondaga County, N. Y.; 2, 3, Brewerton, Onondaga County, N. Y.
All in collection of N. Y. State Museum.
Material: All of Harrison County, Ind. flint.

NEW YORK PROJECTILE POINTS

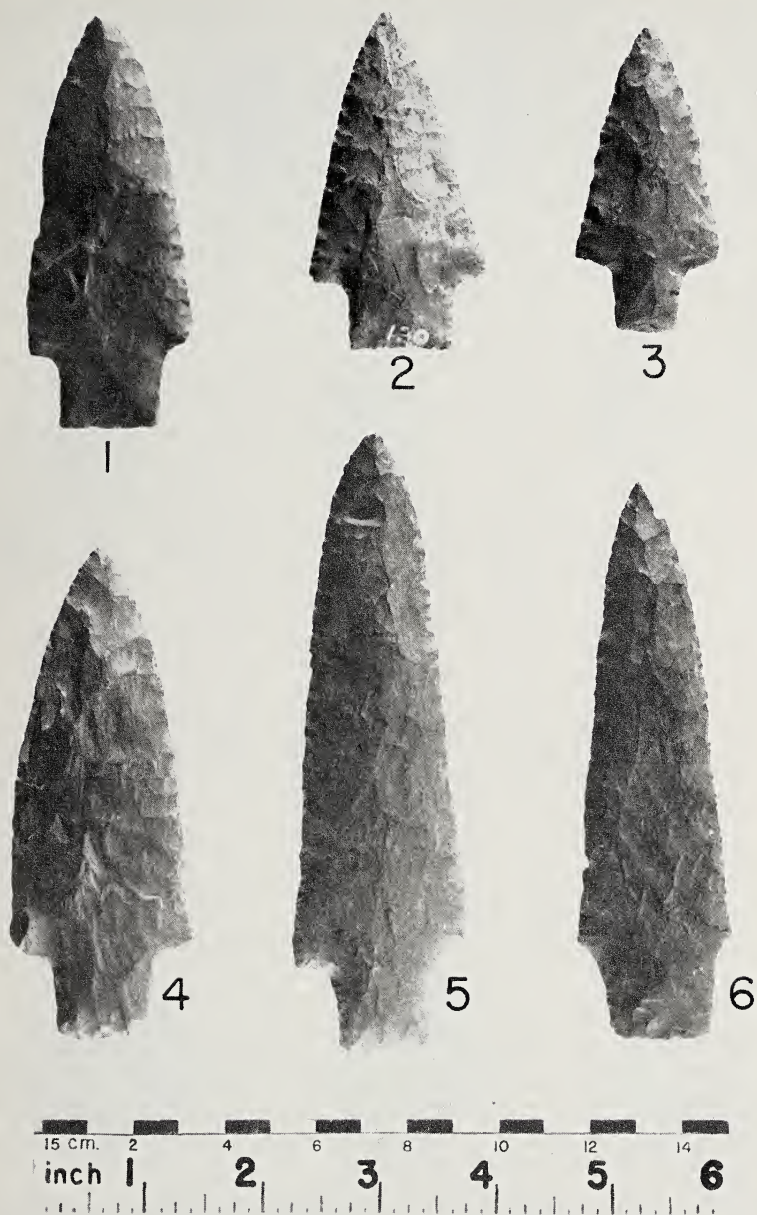


PLATE 10—GENESEE POINTS

1, 3, 6, Lysander, Onondaga County, N. Y.; 2, Gucker site, Charlotte, Monroe County, N. Y.; 4, Wyoming County, N. Y.; 5, Onondaga County, N. Y. (?).

All in collection of N. Y. State Museum.

Material: All of Onondaga flint.

PLATE 11—JACK'S REEF CORNER-NOTCHED POINTS

1-3, 7, Van Buren, Onondaga County, N. Y.; 4, Coh. 9 site, Rensselaer County, N. Y.; 5, 8, 10, 11, Onondaga County, N. Y.; 6, Van Orden site, Greene County, N. Y.; 9, Afton, Chenango County, N. Y.; 12, Lysander, Onondaga County, N. Y.; 13, Onondaga County, N. Y. (?).

4, 6, Carl S. Sundler collection; others N. Y. State Museum collection.

Material: 1, 2, 13, jasper; 5, Flint Ridge, Ohio chalcedony; others Onondaga flint.

NEW YORK PROJECTILE POINTS



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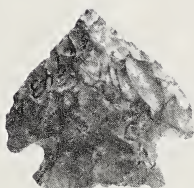
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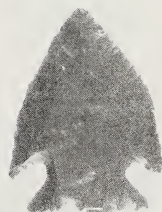
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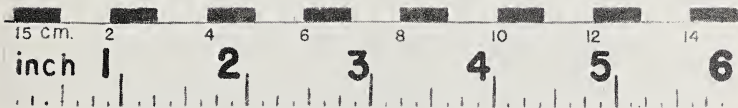
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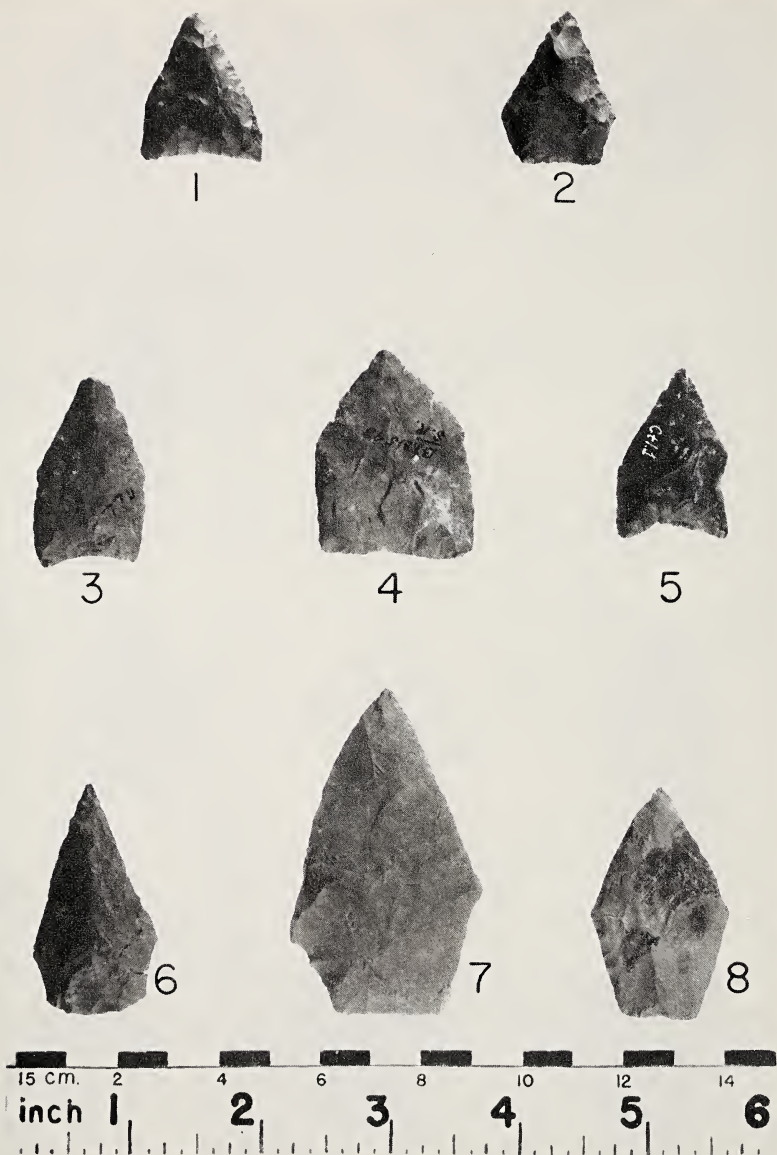


PLATE 12—JACK'S REEF PENTAGONAL POINTS

1, Wickham site, Brewerton, Oswego County, N. Y.; 2, 4, 6, 7, Onondaga County, N. Y.; 3, Clifton Park, Saratoga County, N. Y.; 5, 8, Van Orden site, Greene County, N. Y. 5, 8, collection of Carl S. Sundler; others N. Y. State Museum collection.
Material: 7, 8, Deepkill flint; others of Onondaga flint.

PLATE 13—LAMOKA POINTS

1-12, 14-17, 20-24, Frontenac Island site, Cayuga County, N. Y.; others Lamoka Lake site, Schuyler County, N. Y.

All N. Y. State Museum collection.

Material: All of Onondaga flint, except 9, 13, 17, 23, 27, which are of argillaceous quartzite.

NEW YORK PROJECTILE POINTS



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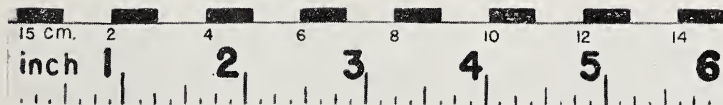


PLATE 14—LAMOKA AND "DUSTIN" POINTS

1-9, "Dustin" points, surface sites in Michigan; others Lamoka Lake site, Schuyler County, N. Y.

1-9, Museum of Anthropology, University of Michigan collection; others collection of Rochester Museum of Arts and Sciences.

Material: 1-9, various flints and jaspers; others Onondaga flint, except 18, which is of argillaceous quartzite.

NEW YORK PROJECTILE POINTS

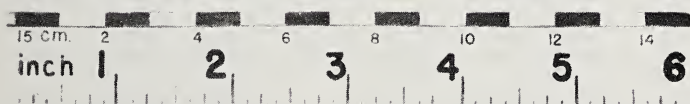
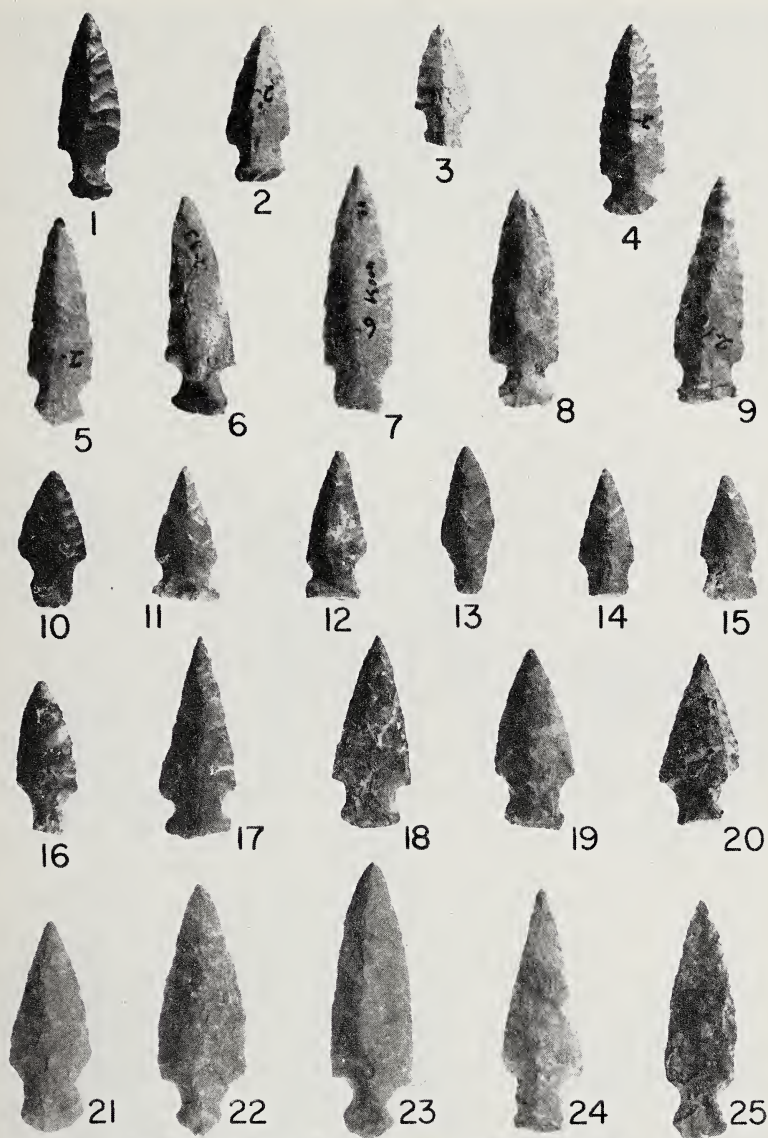


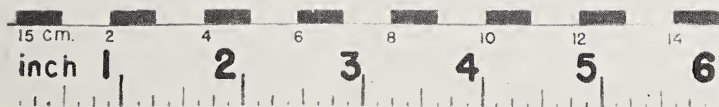
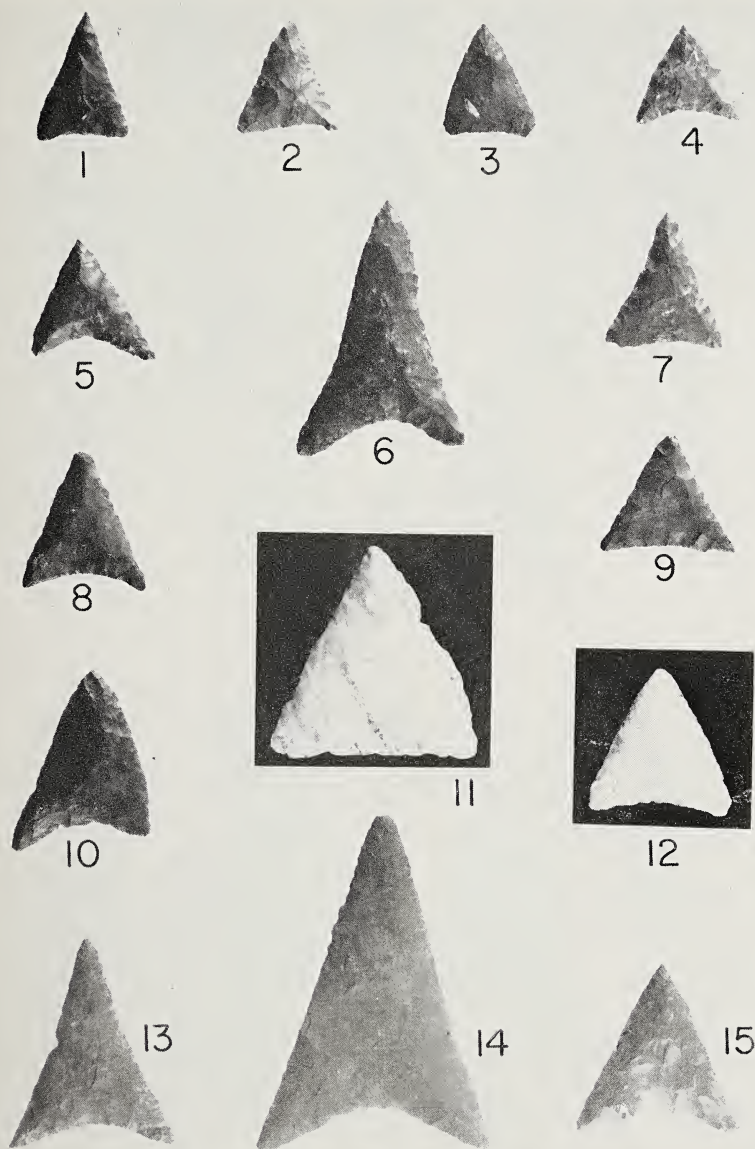
PLATE 15—LEVANNA POINTS

1, 3, 6-9, Wickham site, Brewerton, Oswego County, N. Y.; 2, 4, Sackett site, Canandaigua, Ontario County, N. Y.; 5, Chemung County, N. Y.; 10, South Cruger Island site, Dutchess County, N. Y.; 11, Patchogue, Suffolk County, N. Y.; 12, Schaghticoke, Rensselaer County, N. Y.; 13, Van Orden site, Greene County, N. Y.; 14, Clifton Park, Saratoga County, N. Y.; 15, Bates site, Chenango County, N. Y.

All collection of N. Y. State Museum, except 13, collection of Carl S. Sundler.

Material: All Onondaga flint, except 11, 12, which are of quartz.

NEW YORK PROJECTILE POINTS



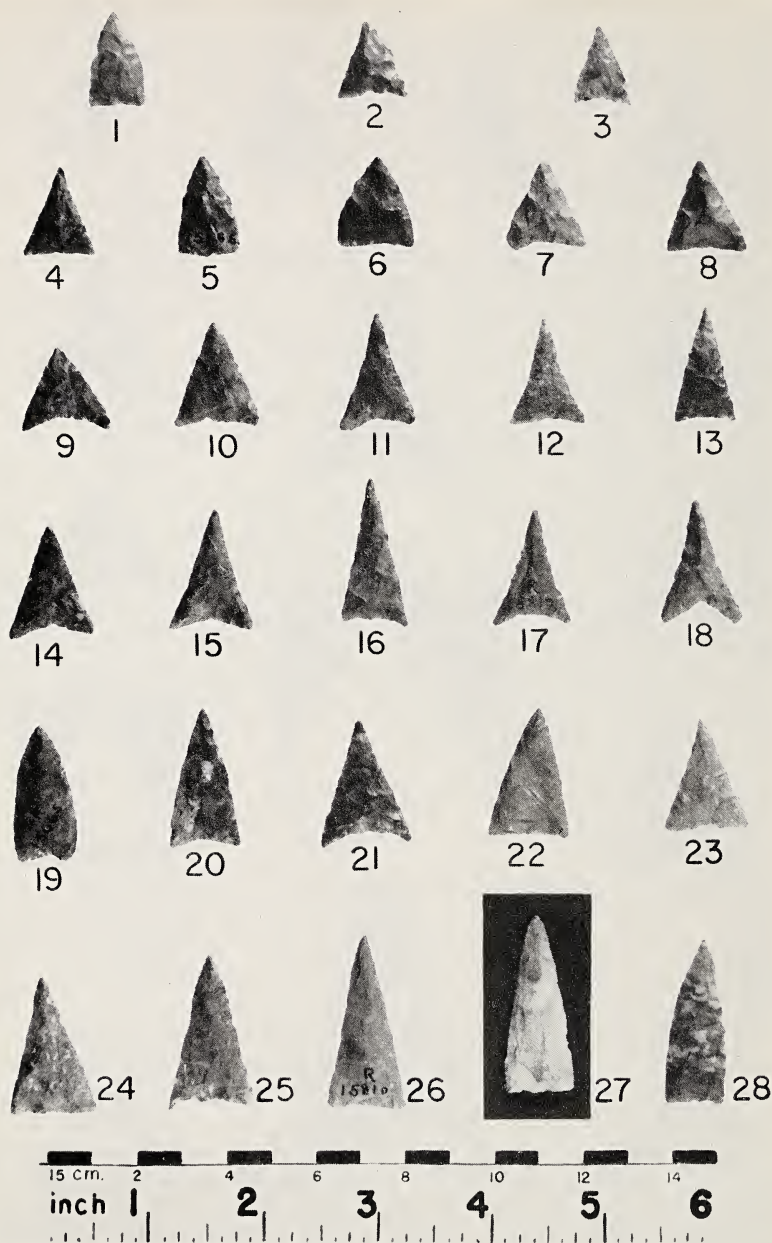


PLATE 16—MADISON POINTS

George Reed site, Richmond Mills, Ontario County, N. Y.

N. Y. State Museum collection.

Material: All Onondaga flint, except 27, which is of Flint Ridge, Ohio chalcedony, a very unusual material for Madison points.

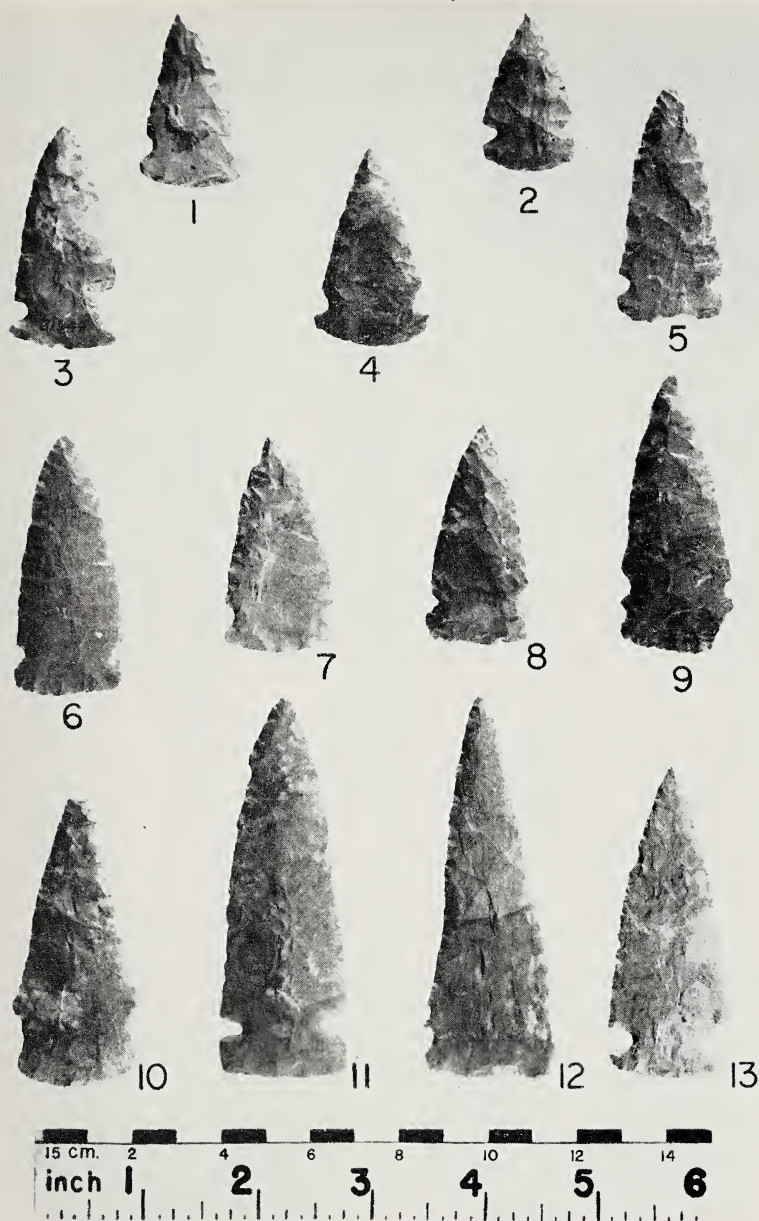


PLATE 17—MEADOWWOOD POINTS

1, 2, 4, 5, 7-9, 11, Onondaga County, N. Y.; 3, 6, Elbridge, Onondaga County, N. Y.; 10, 13, Morrow site, Honeoye, Ontario County, N. Y.; 12, Lysander, Onondaga County, N. Y.

Collection of N. Y. State Museum.

Material: All Onondaga flint, chiefly western N. Y. variety.

PLATE 18—NORMANSKILL POINTS

1, 2, 6, 9, 18, Harris site, Saratoga County, N. Y.; 3, 15, Vosburg site, Albany County, N. Y.; 4, 8, 10, 14, 16, 17, River site, Saratoga County, N. Y.; 5, 13, 19, South Cruger Island site, Dutchess County, N. Y.; 7, 12, Coh. 9 site, Rensselaer County, N. Y.; 11, West Albany, Albany County, N. Y.

1, 2, 5, 6, 9, 13, 18, 19, collection of N. Y. State Museum; 3, 15, collection of James H. Zell; 4, 7, 8, 10, 14, 16, 17, collection of William Kirby; 11, 12, collection of Carl S. Sundler.

Material: All eastern N. Y. flints—Deepkill, Normanskill and Fort Ann.

NEW YORK PROJECTILE POINTS

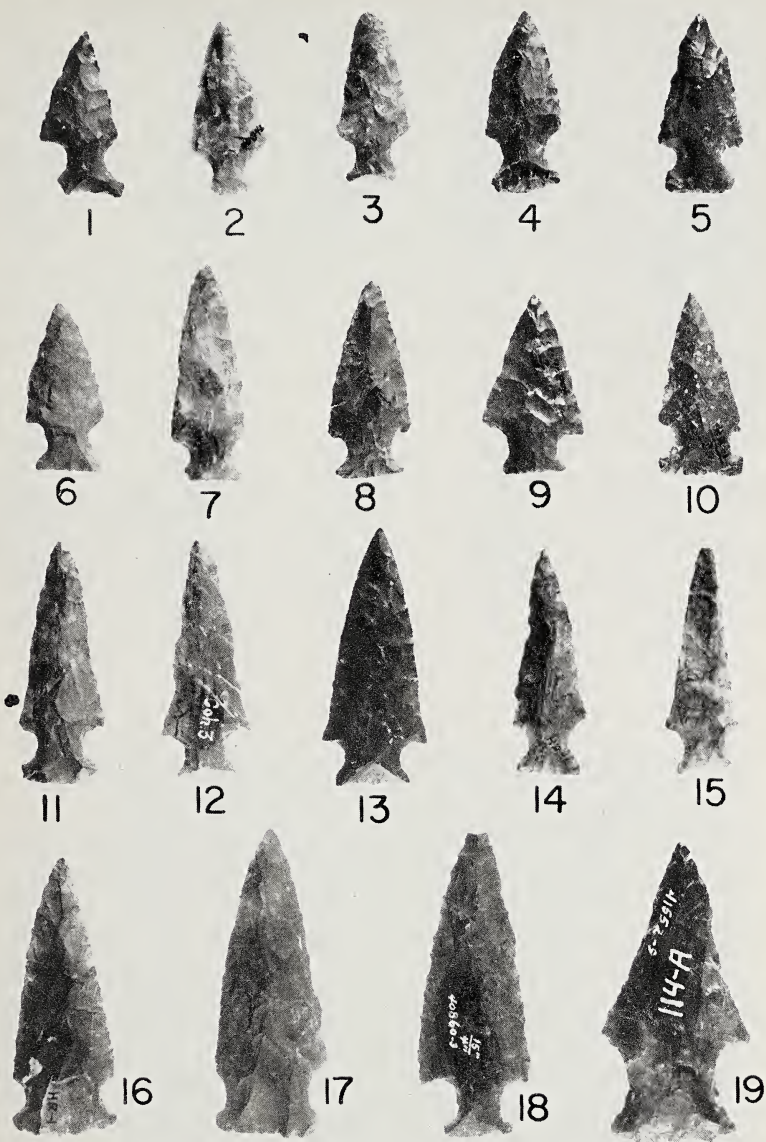


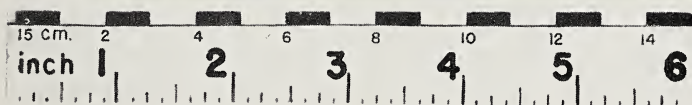
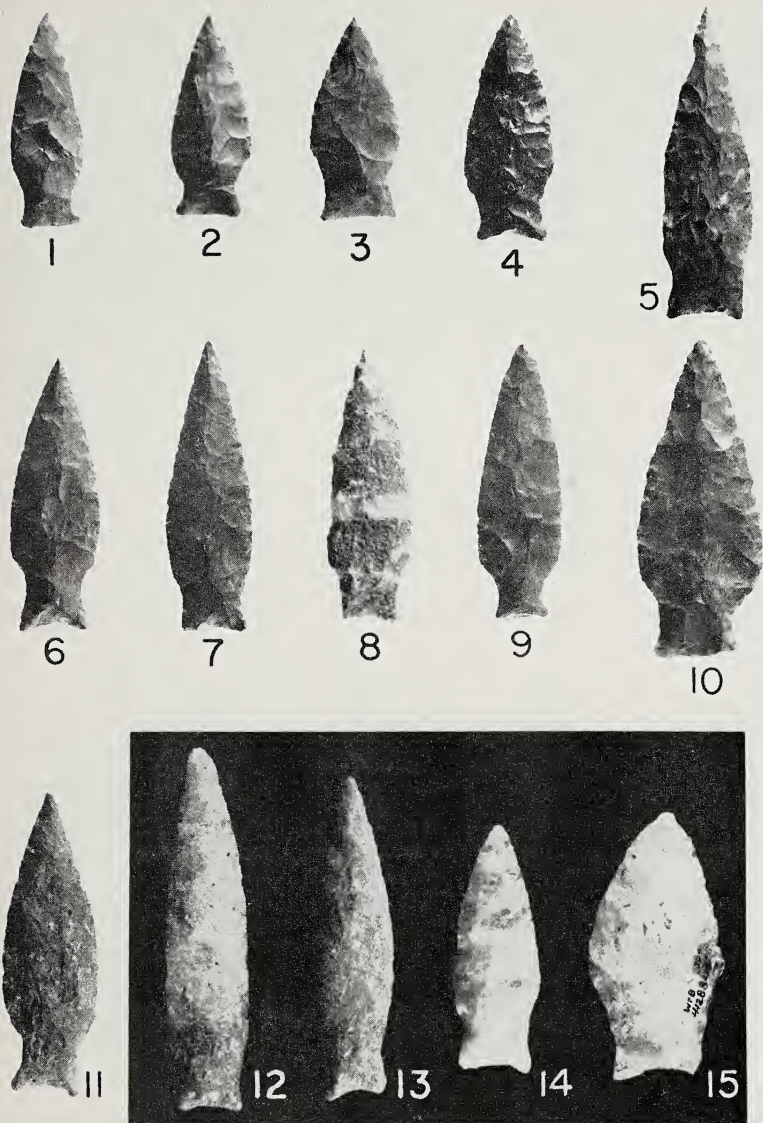
PLATE 19—ORIENT FISHTAIL POINTS

1-4, 6, 7, 9, Van Orden site, Greene County, N. Y.; 5, 8, 13-15, Jamesport site, Suffolk County, N. Y.; 10, Lysander, Onondaga County, N. Y.; 11, 12, Stony Brook site, Suffolk County, N. Y.

1-4, 6, 7, 9, Carl S. Sundler collection; others N. Y. State Museum collection.

Material: 1, Normanskill flint; 2-7, 9, Deepkill flint; 8, 11-13, quartzite; 14, 15, quartz.

NEW YORK PROJECTILE POINTS



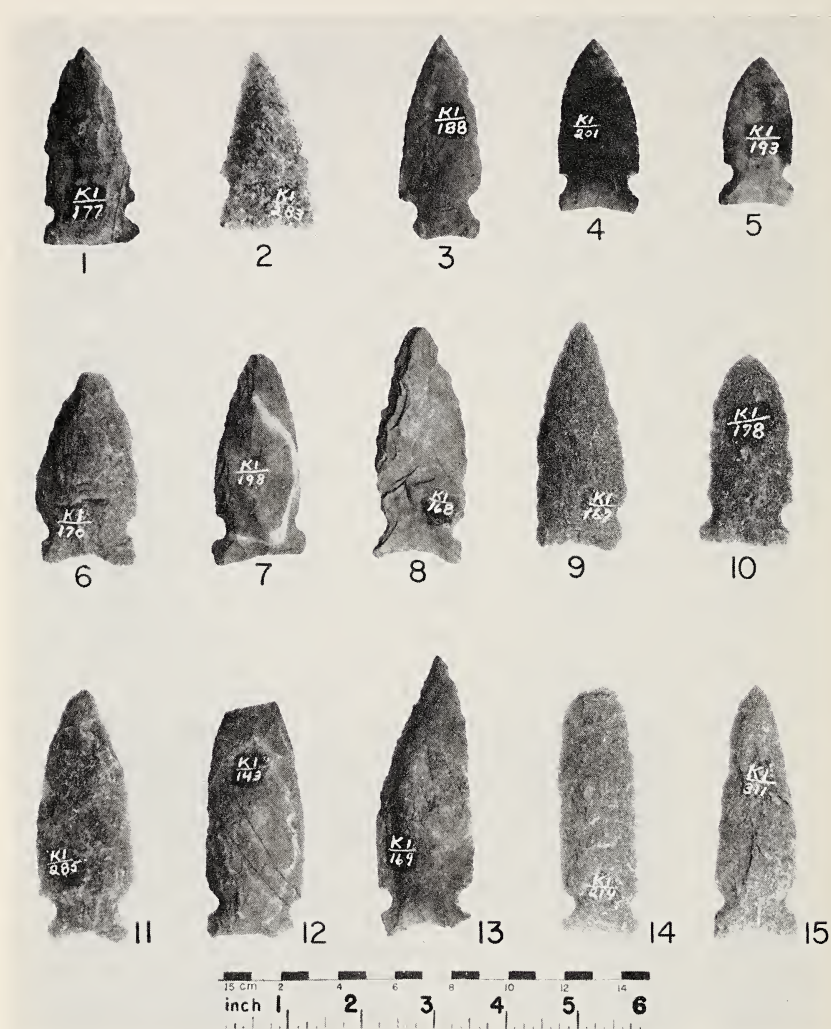


PLATE 20—OTTER CREEK POINTS

KI site, Rutland County, Vt.

2, 4, 6-9, 11, 13-15, collection of Thomas E. Daniels; others collection of Kathleen Rowlands.

Material: 1, 12, 13, metamorphosed siltstone; 2, 6, 9-11, 14, 15, quartzite; 3, 7, 8, Normanskill (?) flint; 4, 5, banded gray flint.

PLATE 21—OTTER CREEK POINTS

- 1, 4, 5, Van Orden site, Greene County, N. Y.; 2, 6, 7, Malta, Saratoga County, N. Y.;
- 3, South Cruger Island site, Dutchess County, N. Y.

1, 4, 5, collection of Carl S. Sundler; others N. Y. State Museum collection.

Material: All Normanskill flint.

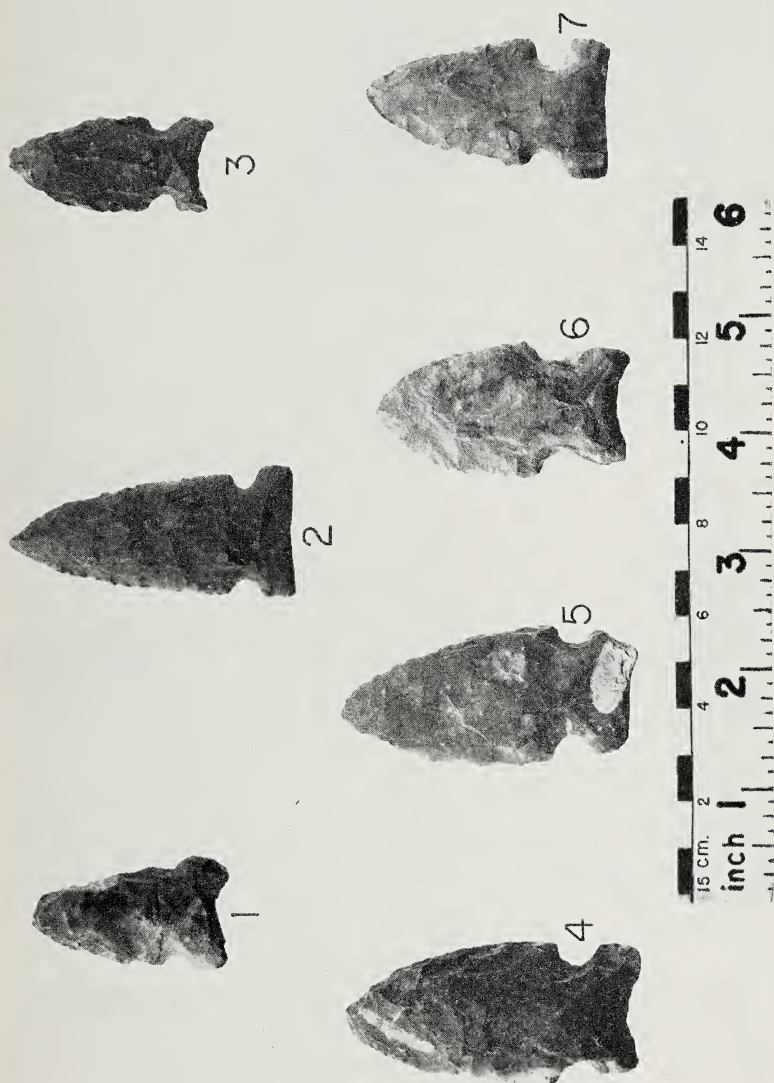




PLATE 22—OTTER CREEK POINTS

1, Stillwater, Saratoga County, N. Y.; 2, Bemis Heights, Saratoga County, N. Y.;
3, Fish Creek, Saratoga County, N. Y.

N. Y. State Museum collection.
Material: All Normanskill flint.

NEW YORK PROJECTILE POINTS

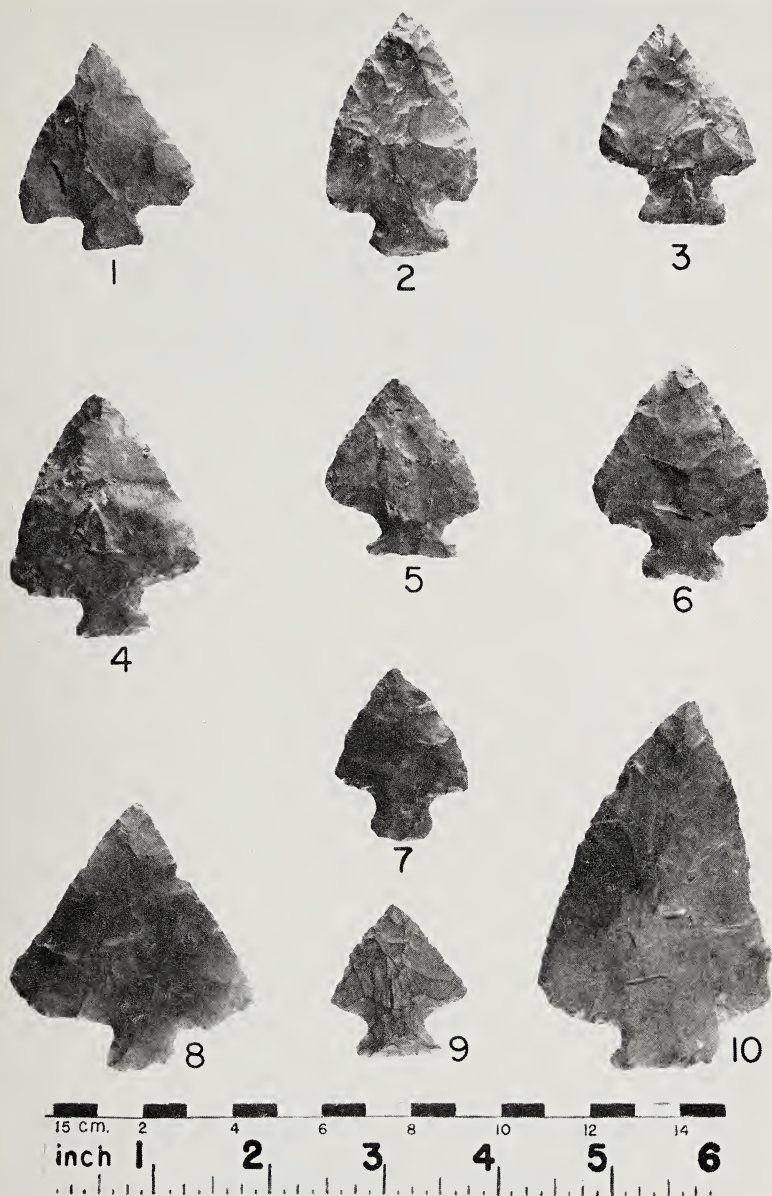


PLATE 23—PERKIOMEN BROAD POINTS

Found along Seneca River, Onondaga County, N. Y.

N. Y. State Museum collection.

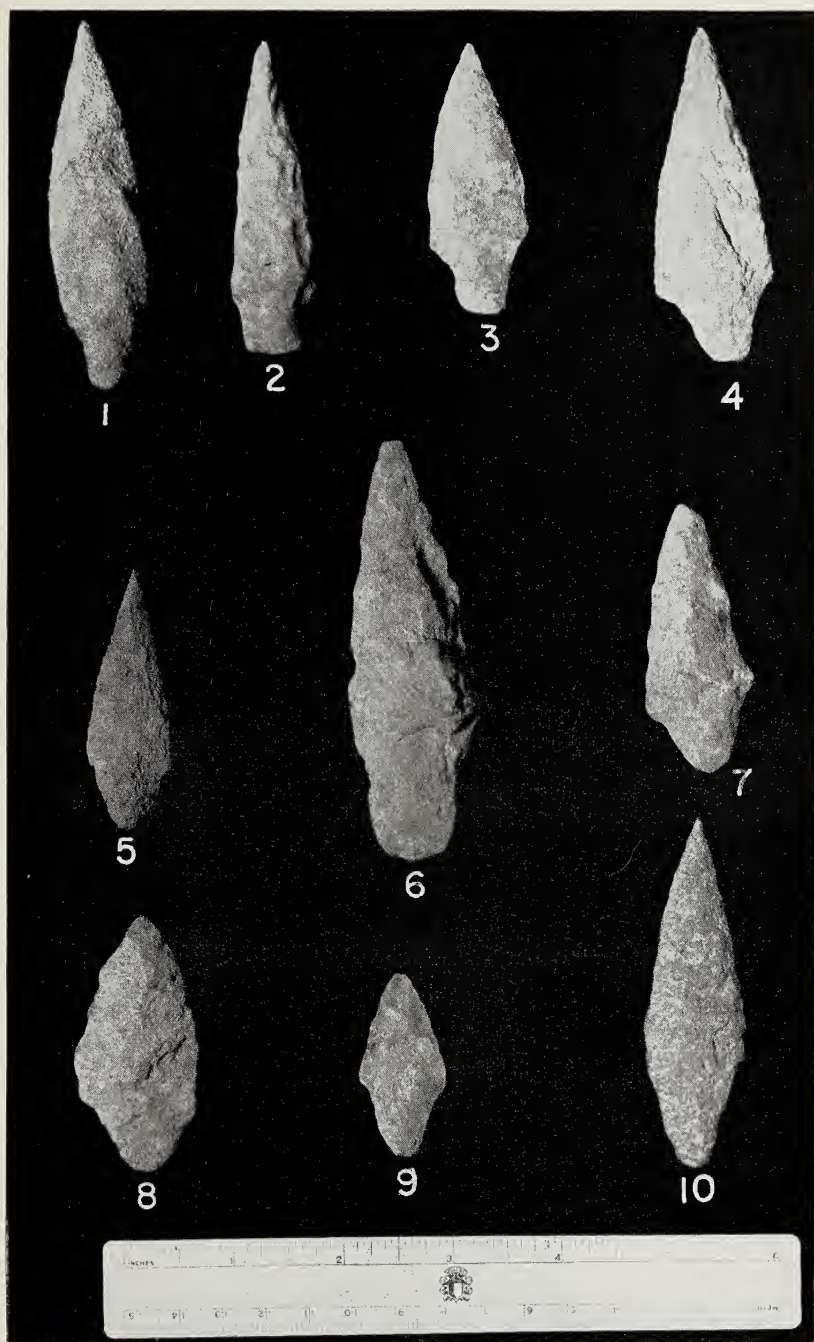
Material: All Onondaga flint.

PLATE 24—POPLAR ISLAND POINTS

Kent-Hally site, Bare Island, Lancaster County, Pa.

Collection of Pennsylvania Historical and Museum Commission by whose courtesy they are reproduced.

Material: Argillite and siltstone.



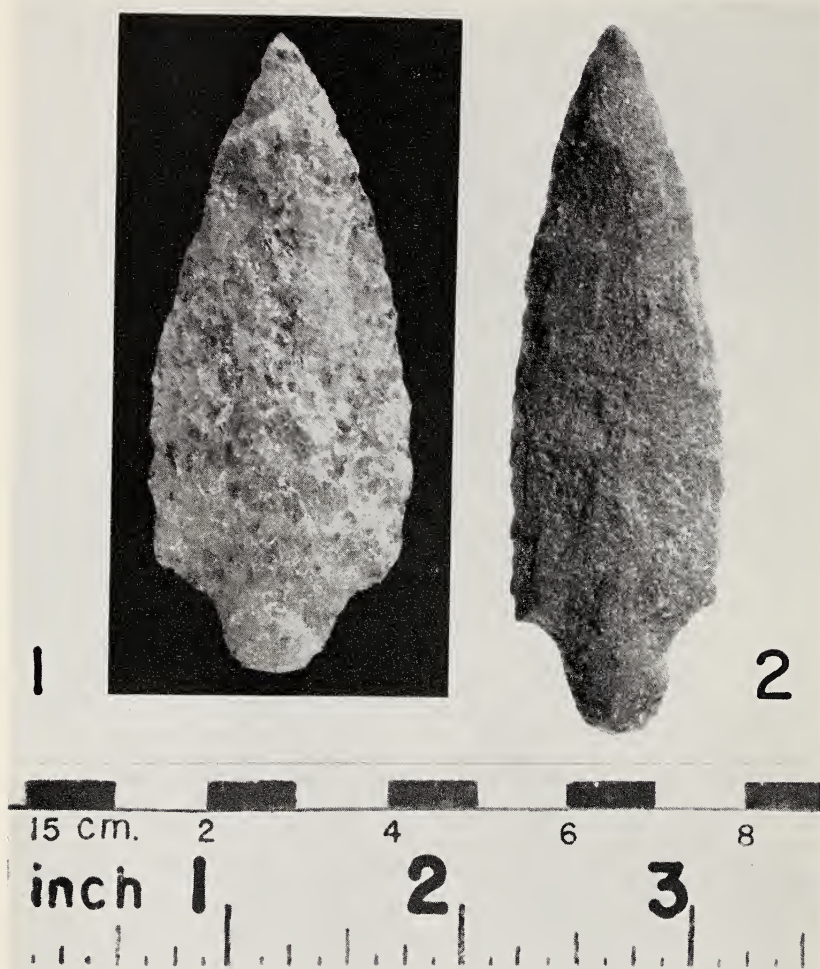


PLATE 25—POPLAR ISLAND POINTS

1, 2, Van Orden site, Greene County, N. Y.
Collection of Carl S. Sandler.
Material: quartzite.

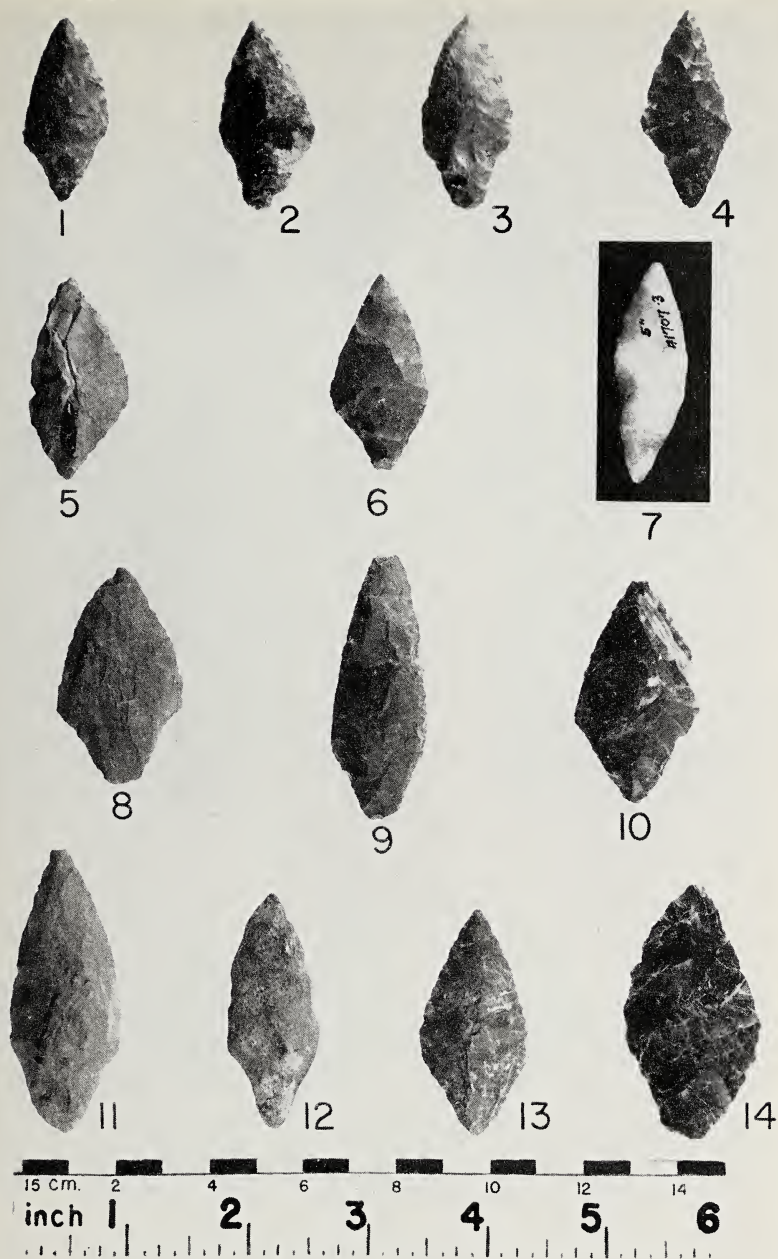


PLATE 26—ROSSVILLE POINTS

1, 5, 12, Bannerman site, Dutchess County, N. Y.; 2-4, 6, 8-11, 13, 14, Van Orden site, Greene County, N. Y.; 7, Stony Brook site, Suffolk County, N. Y.

1, 5, 7, 12, collection of N. Y. State Museum; others Carl S. Sundler collection.

Material: 1, 3, 6, 8-10, 13, 14, Deepkill flint; 2, 4, Fort Ann flint; 7, quartz; 11, 12, argillaceous siltstone.

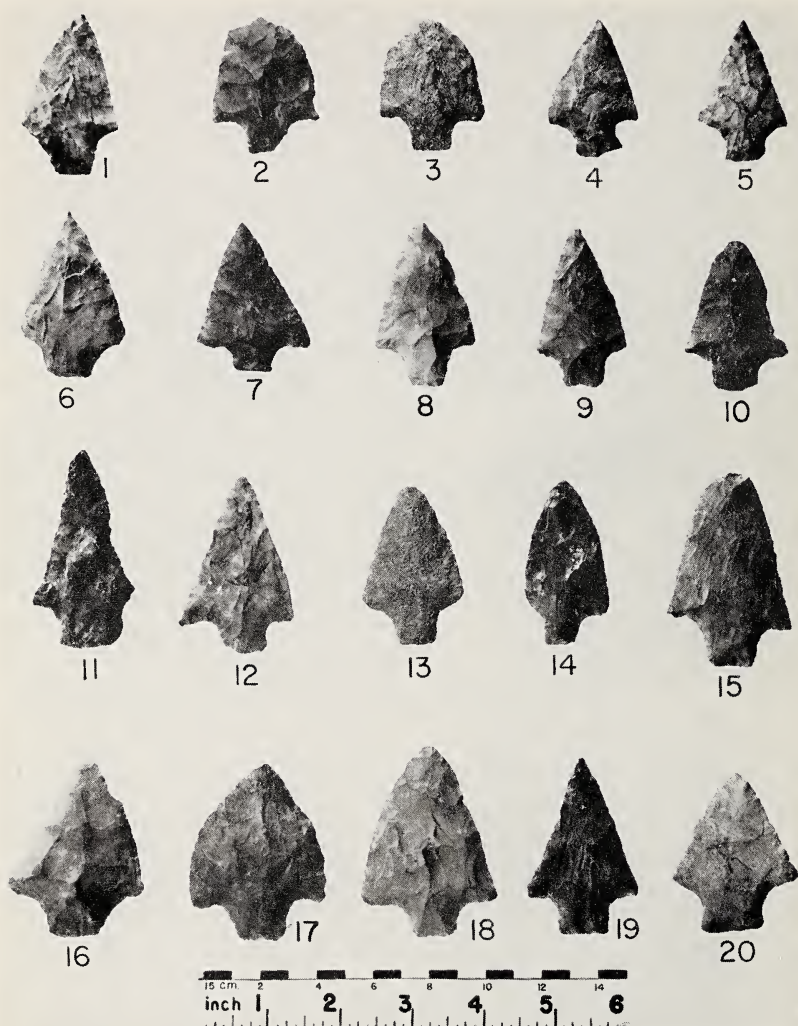


PLATE 27—SNOOK KILL POINTS

Weir site, Rensselaer County, N. Y.

Collection of James H. Zell.

Material: 1, 2, 4-8, 10-12, 15-20, Normanskill flint; 3, Oriskany flint; 9, 14, Onondaga flint; 13, argillite.

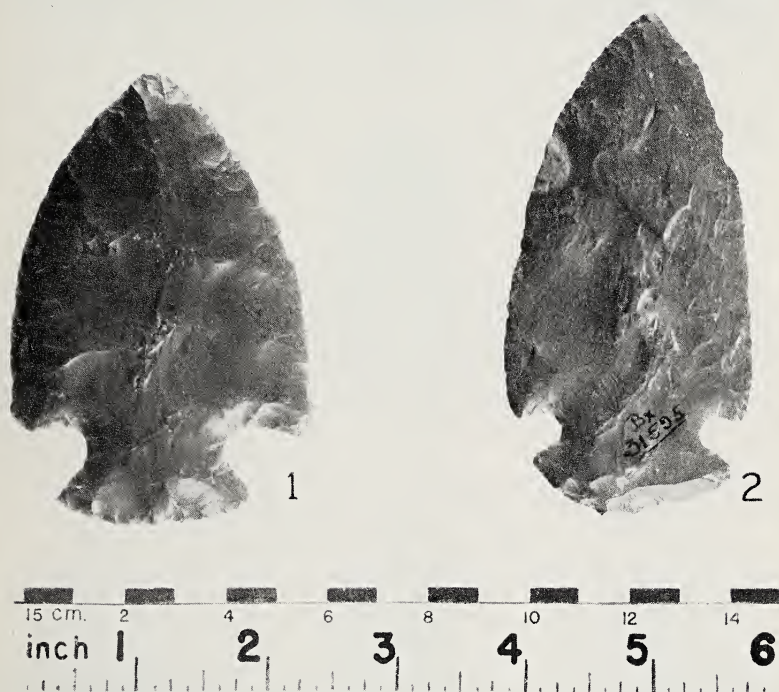


PLATE 28—SNYDERS POINTS

1, Portageville, Livingston County, N. Y.; 2, Seneca River, Onondaga County, N. Y.
Collection of N. Y. State Museum.

Material: 1, Harrison County, Ind. flint; 2, Onondaga flint (?).

PLATE 29—STEUBENVILLE LANCEOLATE POINTS

1-3, 5, 6, 8, Ford site, Columbia County, N. Y.; 4, Four Mile Point, Greene County, N. Y.; 7, Van Buren, Onondaga County, N. Y.; 9, Clifton Park, Saratoga County, N. Y.

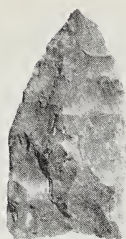
1-3, 6, collection of Edward B. Christman; 4, 7, 9, N. Y. State Museum collection; 5, 8, collection of R. Arthur Johnson.

Material: 1, 2, 6, Deepkill flint; 3, 5, 9, Norman kill flint; 4, 8, argillite; 7, Oriskany flint.

NEW YORK PROJECTILE POINTS



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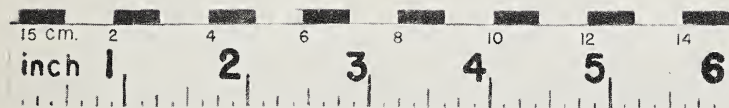


PLATE 30—STEUBENVILLE STEMMED POINTS

1-3, 6, 7, Ford site, Columbia County, N. Y.; 4, Four Mile Point, Greene County, N. Y.; 5, Roger's Island, Columbia County, N. Y.; 8, Coh. 9 site, Rensselaer County, N. Y.; 9, Seneca River, Onondaga County, N. Y.

1, 3, 6, 7, collection of Edward B. Christman; 2, 4, 5, 9, collection of N. Y. State Museum; 8, collection of Carl S. Sandler.

Material: 1, 3, Deepkill flint; 2, 6, argillite; 4, Oriskany flint; 5, 8, Normanskill flint; 7, 9, Onondaga flint.

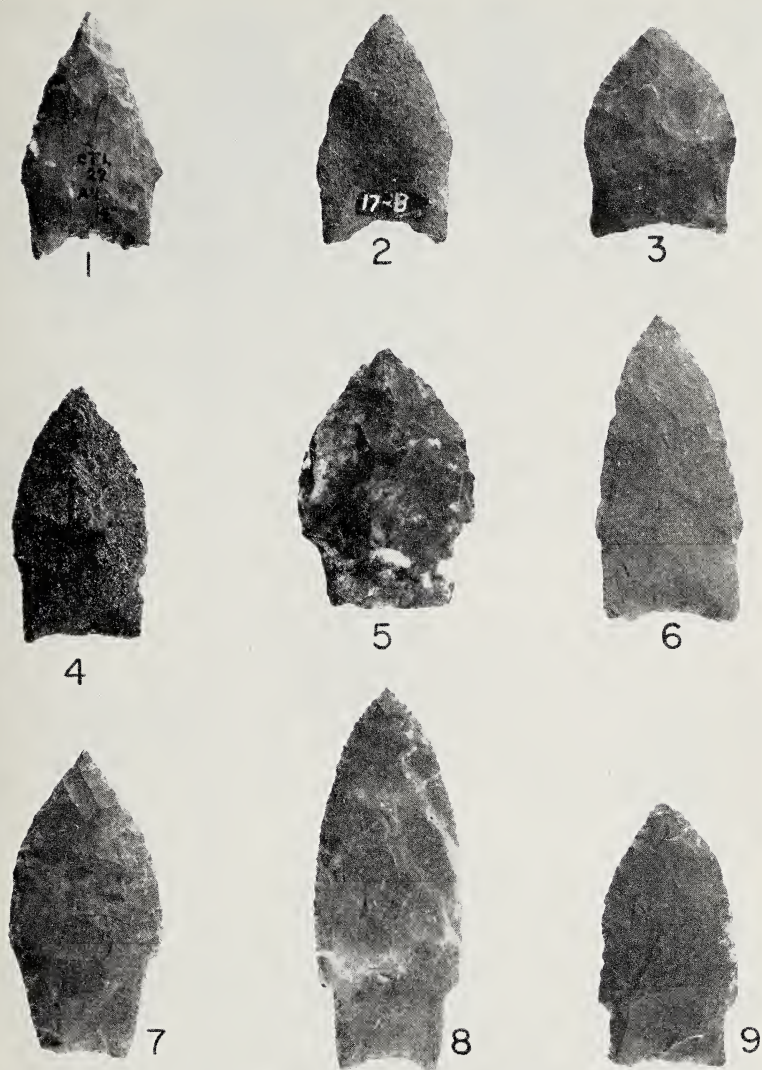


PLATE 31—SUSQUEHANNA BROAD POINTS

1-3, Seneca River, Onondaga County, N. Y.; 4, 6, 10, New Berlin, Chenango County, N. Y.; 5, 7, 8, Chemung County, N. Y.; 9, 11, Lysander, Onondaga County, N. Y. Collection of N. Y. State Museum.

Material: 1-3, 9, 11, Onondaga flint; others rhyolite.

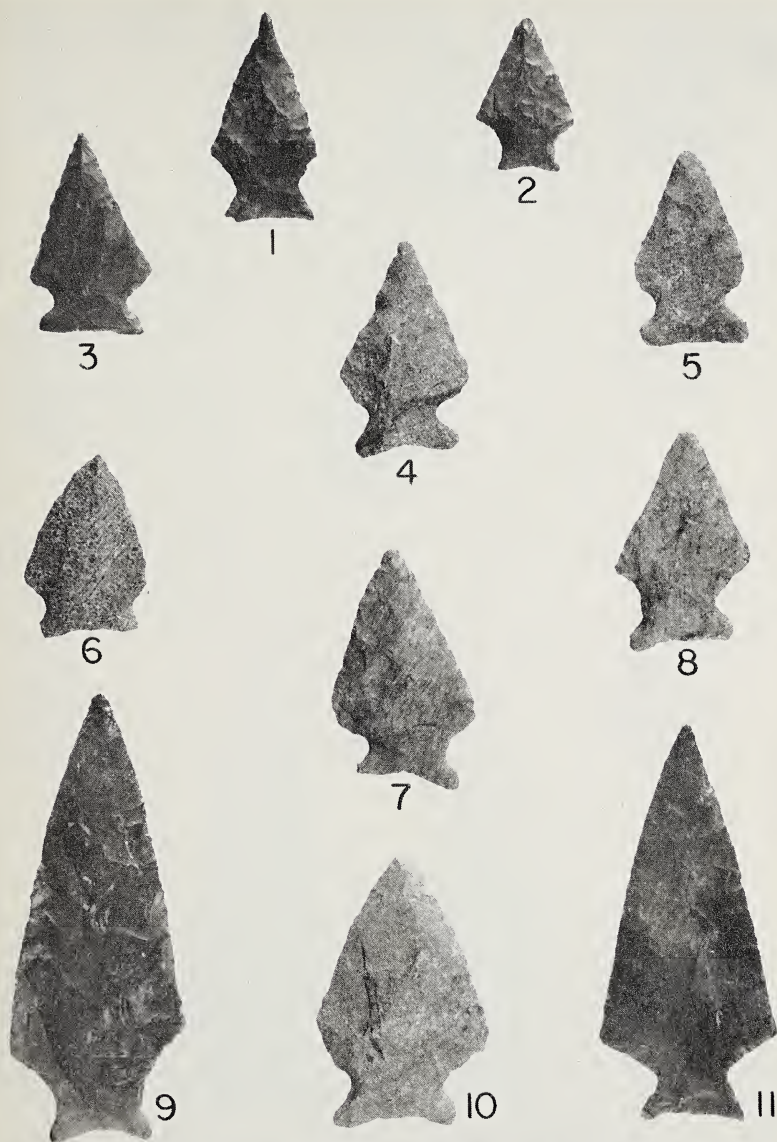


PLATE 32—VOSBURG POINTS

1, Covered Bridge site, Albany County, N. Y.; 2, 5, 10, Dunsbach Ferry site, Albany County, N. Y.; 3, 11, Glens Falls, Warren County, N. Y. 4, 7, 13, Van Orden site, Greene County, N. Y.; 6, Onondaga County, N. Y.; 8, Cossackie Flint Mine, Greene County, N. Y.; 9, Vosburg site, Albany County, N. Y.; 12, Four Mile Point, Greene County, N. Y. 1, 2, 4, 5, 7, 9, 10, 13, collection of Carl S. Sandler; others N. Y. State Museum collection. Material: Deepkill and Normanskill flints.



1



2



3



4



5



6



7



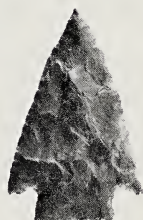
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12



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10



13



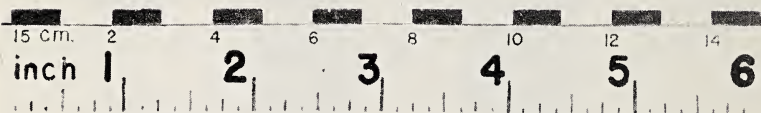
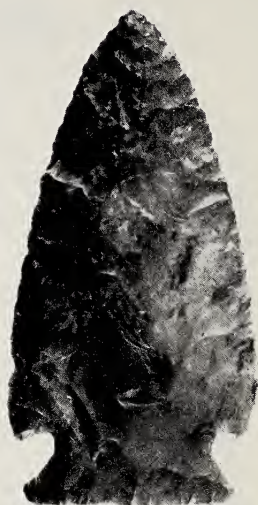
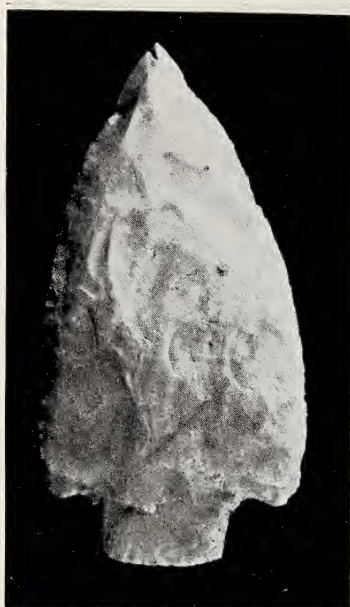


PLATE 33—POINTS OF EXOTIC FLINT

1, broad-bladed, thin, straight stemmed point, from Seneca River, Onondaga County, N. Y. This is apparently an undesignated point form of the Adena culture, which occurs also in the related Middlesex complex of the Northeast (see Ritchie and Dragoo, 1960, plate 8, figures 1, 2, 4, 5).

2, broad-bladed, thin, corner-notched point from the Genesee Valley of western N. Y. It seems to be an unusually large example of the Jack's Reef Corner-Notched type (see plate 11). Similar specimens are found in Hopewell culture sites of Ohio and elsewhere.

Material: Both points are made of Flint Ridge, Licking County, Ohio chalcedony.

NEW YORK PROJECTILE POINTS

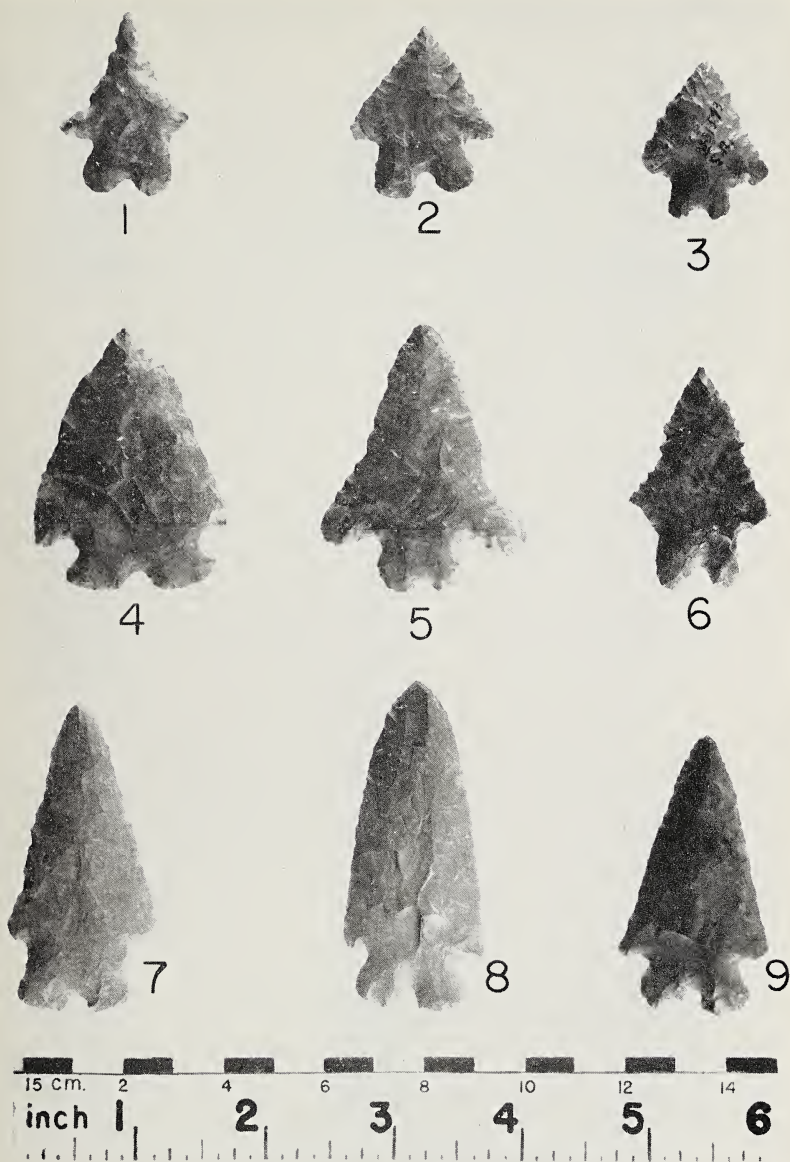


PLATE 34—UNTYPED BIFURCATED BASE POINTS

1, 3-5, 7, 9, Onondaga County, N. Y.; 2, Van Orden site, Greene County, N. Y.; 6, Bannerman site, Dutchess County, N. Y.; 8, Lysander, Onondaga County, N. Y. 2, collection of Carl S. Sundler; others N. Y. State Museum collection.

Material: 1, Flint Ridge, Ohio chalcidony; 2, 6, Deepkill flint; others Onondaga flint.

PLATE 35—UNTYPED NARROW TRIANGULAR POINTS

1, 6, Coh. 9 site, Rensselaer County, N. Y.; 2, 3, Round Lake, Saratoga County, N. Y.; 4, Clifton Park, Saratoga County, N. Y.; 5, West Albany, Albany County, N. Y.; 7, Elbridge, Onondaga County, N. Y.; 8, Fish Creek, Saratoga County, N. Y.

1, 5, 6, Carl S. Sundler collection; others N. Y. State Museum collection.

Material: 1, 4, Normanskill flint; 2, 3, 5, 8, Deepkill flint; 6, 7, Onondaga flint.



1



2



3



4



5



6



7



8

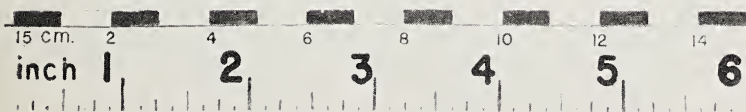


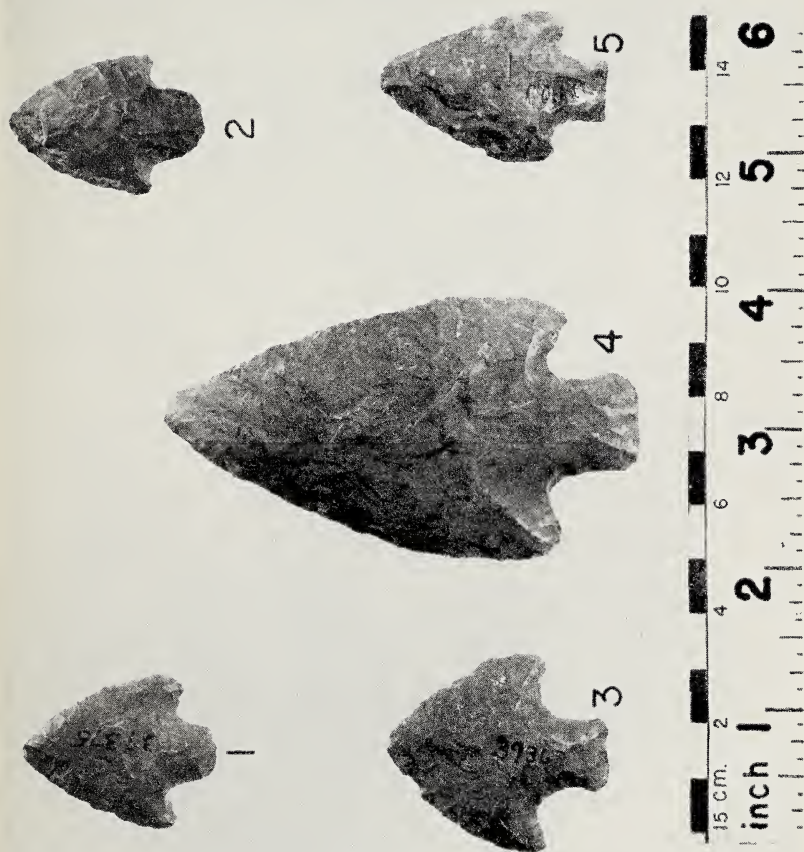
PLATE 36—UNTYPED BROAD-BLADED, STEMMED POINTS

Numbers 1 and 2, especially, resemble Snook Kill points (plate 27), and the group as a whole may represent a variant of this probably Late Archaic type.

1, Fish Creek, Saratoga County, N. Y.; 2, Stillwater, Saratoga County, N. Y.; 3, Clifton Park, Saratoga County, N. Y.; 4, Seneca River, Onondaga County, N. Y.; 5, Van Orden site, Greene County, N. Y.

5, collection Carl S. Sundler; others N. Y. State Museum collection.

Material: 1-3, 5, Deepkill flint; 4, Onondaga flint.



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a TYPOLOGY
and NOMENCLATURE
for NEW YORK
PROJECTILE POINTS

Revised
edition

BY
WILLIAM A. RITCHIE
*State Archeologist
New York State Museum
and Science Service*

REVISED 1971

NEW YORK STATE MUSEUM
AND SCIENCE SERVICE

BULLETIN NUMBER 384

*The University of the State of New York
The State Education Department*

Albany, New York 12224
19797

April 1961

A Typology and Nomenclature for New York Projectile Points

BY

WILLIAM A. RITCHIE

State Archeologist

New York State Museum and Science Service



REVISED 1971

NEW YORK STATE MUSEUM
AND SCIENCE SERVICE
BULLETIN NUMBER 384

The University of the State of New York

The State Education Department

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Preface to Revised Edition

Continuing archeological researches in New York State and elsewhere in the Northeast, chiefly by members of the Anthropological Survey of the New York State Museum and Science Service, have helped to clarify some of the problems of age, cultural affiliations and distribution of several projectile point types treated in this bulletin, as first printed in 1961. They have also produced data for the formulation of ten new point types, which are described and illustrated by a representative example in the appendix. The need for maintaining the present size of the publication has led to the elimination of plates showing the range of variation within the new types, as was earlier done.

The most notable change, in the category of clarification of older data, is the renaming of two related point styles; the Steubenville points are now being termed Fox Creek points on the basis of excavational findings on two sites. Steubenville points were first named, but never formally described, by Mayer-Oakes from his upper Ohio Valley data (pp. 50-52 herein), but a closer comparative study by the writer of these points and their New York State counterparts, indicates the prevailing larger size of the latter, while still suggesting a morphological relationship. The new site evidence has, however, confirmed the writer's prior statements that in southern and eastern New York Steubenville points have early ceramic associations (pp. 50-52, herein).

This evidence comes from two sites in eastern New York. At the smaller, single component, Fredenburg site in Otsego County, excavated by F. J. Hesse in 1967, rude net-marked, plain and dentate-stamped pottery was found with Fox Creek points and other stone artifacts. At the large Westheimer site, excavated by R. E. Funk in 1967 near the junction of Fox Creek with Schoharie Creek, Stratum 3 produced the Fox Creek assemblage with ceramic styles referable to the Middle Woodland stage. Hearth charcoal from the Fredenburg site was radiocarbon dated at A.D. 360 ± 100 years (I-3442), at the Westheimer site at A.D. 450 ± 80 years (Y-2349) and A.D. 410 ± 80 years (Y-2350) (Funk, n.d.). The Middle Woodland provenience of the Fox Creek points is thus firmly established.

The Late Archaic status of the Genesee point (pp. 24-25, herein) has recently been confirmed by its finding in the stratified Dennis site in Albany County, N.Y. (Funk, n.d.), where it occurred in levels immediately above the River phase which has been radiocarbon dated in eastern New York to 1930 B.C. $\pm$ 100 years (Y-1169) (Ritchie, 1965, pp. 124-131).

That this point type pertains primarily to a still undefined and undated assemblage is suggested by its presence as the principal point form on two small sites in eastern New York.

Some light has been thrown by recent excavations in West Virginia and on Staten Island, N.Y. on the problem of the bifurcated base points illustrated on Plate 34. As noted on page 9, it was suspected that this group, unified only by the basal notch, would include more than one type when cultural and temporal data became available. This surmise has, in some measure, been realized. At the deeply stratified St. Albans site in Kanawha County, West Virginia, Broyles has distinguished a Kanawha Stemmed point type from levels 2 and 4, characterized by a shallow notched base, similar to figure 5 on Plate 34, and radiocarbon dated at 6210 B.C. $\pm$ 100 years (Y-1540). The next occupied levels below, zones 6 and 8, produced the Le Croy Bifurcated Base type, with a date of 6300 B.C. $\pm$ 100 years (Y-1539) (Broyles, 1966). Le Croy points are very like those illustrated on Plate 34, figures 1-3, 6.

Excavations in 1967-68 on the Hollowell site in southern Staten Island, by Donald Hollowell and Albert Anderson, have uncovered in the lowest artifact-bearing zone a rough, polished and chipped stone complex which includes bifurcated base points conforming mostly to the Kanawha type. In 1969, Hollowell and Anderson, excavating on the Ward's Point site at Tottenville, Staten Island, found a similar complex in which Le Croy points were also present, in the deepest level. Charcoal particles from this zone provided a radiocarbon date of 5310 B.C. $\pm$ 125 years (I-4512) for this new and still undefined complex on Staten Island (Ritchie and Funk, n.d.).

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CONTENTS

	PAGE
Introduction	5
Explanation	9
Table 1	10
Table 2	10
Adena points	12
Bare Island points	14
Brewerton Corner-Notched points	16
Brewerton Eared-Notched points	17
Brewerton Eared-Triangle points	18
Brewerton Side-Notched points	19
Clovis points	21
Fulton Turkey Tail points	23
Genesee points	24
Jack's Reef Corner-Notched points	26
Jack's Reef Pentagonal points	28
Lamoka points	29
Levanna points	31
Madison points	33
Meadowood points	35
Normanskill points	37
Orient Fishtail points	32
Otter Creek points	40
Perkiomen Broad points	42
Poplar Island points	44
Rossville points	46
Snook Kill points	47
Snyders points	49
Steubenville Lanceolate points	50
Steubenville Stemmed points	51
Susquehanna Broad points	53
Vosburg points	55
References	57
Appendix	120

ILLUSTRATIONS

	PAGE
Figure 1—Standard projectile point terminology	11
Plate 1—Adena points	61
Plate 2—Bare Island points	63
Plate 3—Bare Island points	64
Plate 4—Brewerton Corner-Notched points	67
Plate 5—Brewerton Eared-Notched points	69
Plate 6—Brewerton Eared-Triangle points	71
Plate 7—Brewerton Side-Notched points	72
Plate 8—Clovis points	75
Plate 9—Fulton Turkey Tail points	76
Plate 10—Genesee points	77
Plate 11—Jack's Reef Corner-Notched points	79
Plate 12—Jack's Reef Pentagonal points	80
Plate 13—Lamoka points	83
Plate 14—Lamoka and "Dustin" points	85
Plate 15—Levanna points	87
Plate 16—Madison points	88
Plate 17—Meadowood points	89
Plate 18—Normanskill points	91
Plate 19—Orient Fishtail points	93
Plate 20—Otter Creek points	94
Plate 21—Otter Creek points	97
Plate 22—Otter Creek points	98
Plate 23—Perkiomen Broad points	99
Plate 24—Poplar Island points	101
Plate 25—Poplar Island points	102
Plate 26—Rossville points	103
Plate 27—Snook Kill points	104
Plate 28—Snyders points	105
Plate 29—Steubenville Lanceolate points	107
Plate 30—Steubenville Stemmed points	109
Plate 31—Susquehanna Broad points	111
Plate 32—Vosburg points	113
Plate 33—Points of exotic flint	114
Plate 34—Untyped bifurcated base points	115
Plate 35—Untyped narrow triangular points	117
Plate 36—Untyped broad-bladed, stemmed points	119

A Typology and Nomenclature for New York Projectile Points

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Introduction

LONG AND INTIMATE FAMILIARITY with the projectile points of the New York State area led the writer, quite some time ago, to a recognition of about 18 style categories, most of which could be related through site excavations to particular culture complexes and relative time periods. Subsequently, with radiocarbon dating, this chronological sequence was not only sustained but given an approximate actual value. Consequently, projectile point succession, as currently known, spans a period of about 5,000 years before the present.

Until rather recently, the author has discussed these projectile points in site reports and elsewhere in such general descriptive terms as broad, heavy, side-notched points, or narrow-bladed stemmed points, while at the same time exhibiting a tendency to refer to the very same points as Brewerton or Laurentian side-notched points, or Lamoka stemmed points, in accordance with the cultural associations he has been able to demonstrate through excavations.

The need for some convenient classification and nomenclature to replace this awkward phraseology has grown more insistent with the progress of research. The utility of a ceramic typology for the same area¹ encouraged the effort, which has currently attained to the dimensions indicated by the present publication. It seems safe to predict, especially in view of the still untyped points discussed below, that continuing research within the area will lead to the addition of new types, and, with some probability, to certain revisions of the series herein defined.

As the term is employed in this study, projectile points include: arrowpoints; dartpoints, or the armament of javelins or short throwing spears, hurled by hand either directly or with the aid of a dart thrower or atlatl; and spearpoints, or the stabbing heads affixed to relatively

¹ Ritchie and MacNeish, 1949; MacNeish, 1952.

long-handled thrusting weapons, not designed to leave the hand. Since in many, perhaps most, instances, the function cannot with certainty be deduced from the remaining part, the writer's attempts at such identification, where hazarded, are equivocal.

Furthermore, certain of the objects herein described (as in the Fulton Turkey Tail type) may have been primarily or interchangeably used as specialized cutting tools or knives. To the best of the author's knowledge and intent, however, only projectile point forms are included in this analysis.

The scope, as suggested by the title, is somewhat misleading, inasmuch as none of the point types herein defined is restricted in range to the geographical limits of the State of New York. In order, however, to achieve a reasonable delimitation to this initial effort for the area, it was decided to include only such point types as were known to have representation within the State's boundaries. It is hoped that other workers in the Northeast will add to the picture with similar analyses of point groups better represented and culturally known in their respective regions, so that ultimately a collation for the entire Northeast can be achieved.

In this typological study the author has been guided by the work of Rouse (1939, 1960), Krieger (1944) and others. The presentation of the data follows, in general, that of Scully (1951), Suhm, Krieger and Jelks (1954), Kneberg (1956) and Bell (1958). The methodology employed is that recommended by Krieger (1944, pp. 279-282) and may be outlined as follows:

1. The material was first sorted into major groups of generally similar points.

2. This sorting, or analysis, was governed by variations in the form, size, proportions, chipping characteristics etc., of such morphological features of the specimens as the blade, stem, notching, base etc., variously referred to by Rouse and Krieger, as "modes" or "attributes." (See figure 1.)

3. These formal variations in the inherent morphological features, modes or attributes became the basis for the tentative classification of the points into types.

4. The next step was the testing of the probable validity of the arbitrarily-constituted type by identifying it in collections from various sites or geographical areas. If it could be shown to persist as an entity with cultural, spatial and/or temporal (i.e., historical) associations, it was felt to be acceptable for the final step in the classification.²

² A total of 10,800 points from eastern, central and western New York were typed in this phase of the work in which the author was assisted by James H. Zell.

5. This step consisted in giving a name and description to the type group.

The description allowed for the observed range of variation in the modes, arising most likely from the vagaries encountered by individual makers in the execution, from a refractory material, of an ideal model or norm. It also provided for sufficient latitude or flexibility, so that minor variations in additional material of the same kind could be encompassed.

Finally, a nomenclature was provided, since the writer agrees with Krieger (1944, pp. 275, 277-279) that for maximum convenience, both in the construction and use of the typology, names, rather than numbers or letters in a classificatory system, should be used. The latter method of designation, usually derived from a geometric analysis and expressed in formulistic terminology, he finds awkward and difficult to remember.

Following Krieger's recommendation, he has chosen a locative nomenclature taken from the site or geographical locale where the type was first found or recognized, occurred most plentifully or was best culturally attributed. Linguistic, ethnic and cultural names (except where the latter is called from a type site; e.g., Lamoka) were avoided.

According to established usage, his descriptions include significant data concerning the age and cultural affiliations, distribution, literary references etc. Any previously employed terminology for the group is included in the latter.

Every effort has been made to avoid attaching new labels to already described point types. Wherever it could be shown, generally by submitting samples of specimens to the person responsible, that the group in question had already been named, the prevailing designation and definition or description (where available) were used explicitly and duly credited.³ Additional data from the New York sample have been clearly incorporated.

Certain fundamental assumptions, which the author shares with his colleagues whose methodology, in general, he has applied, underlie his work on this typology. These may succinctly be stated as follows:

The remarkable stylistic constancy in the modes or attributes, which undeniably can be demonstrated within a series of points collected over a wide geographical range or from numerous components of the same culture complex, indicates the reality of a stylistic model in the

³ The writer gratefully acknowledges cooperation of this kind from the following persons: Lewis R. Binford, Don W. Drago, W. Fred Kinsey III, William J. Mayer-Oakes and John Witthoft. For the loan of specimens used in this study, the writer is also indebted to Edward B. Christman, Thomas E. Daniels, R. Arthur Johnson, William J. Kirby, Museum of Anthropology of the University of Michigan, Rochester Museum of Arts and Sciences, Carl S. Sundler and James H. Zell.

minds of the prehistoric makers. Clearly they were working not from caprice but from a "cultural compulsive" which impelled them to conform to current fashions or established norms for their particular area and period. The surviving material product of this long extinct cultural concept can be recognized by the typologist and analyzed by means of definite morphological features of form, proportions etc., into various attributes or modes, as already outlined. Although these attributes are arbitrarily selected to conform to the purposes of the investigator, it is believed that the end product of the analysis approximates in important formal respects the ideal or norm of the maker.

It is further assumed that the typological configurations reflect standardized behavior and the fixation of motor habits, through traditional or culturally approved ways of doing things in the aboriginal society concerned. The strong conservatism, widely remarked for primitive societies, seems to be well illustrated in the marked degree of uniformity found within each of our point type categories (Boas, 1927, p. 145ff.; Redfield, 1953, pp. 14, 120).

Finally, it should be made explicit that in these statements regarding the "recapture" of ancient cultural concepts, the author is fully aware that, as Rouse and others have pointed out, "Culture does not consist of artifacts. The latter are merely the results of culturally conditioned behavior performed by the artisan. Types and modes express the culture which conditions the artisan's behavior." (Rouse, 1939, p. 15.)

In more philosophical phraseology, "All records show only the apparent forms of the truly existing inner reality." (Wilhelm Dilthey, quoted in Kluback, 1956, p. 60.)

As has been stated on page 6, the probable validity of the typology derived in the present study from the combination of a background of long familiarity with the materials and the specific analysis of several thousand specimens, was tested in the fourth step of the procedure by application to 10,800 additional projectile points. These formed part of two New York State Museum collections and one private collection from surface sites which were selected to represent an equal number of areas in the State. They came, respectively, from the middle regions of the Hudson River Valley (Greene and Rensselaer Counties), the Seneca River Valley (Onondaga County), and the Genesee River Valley (Livingston County).⁴

⁴ This investigation will be expanded to include more large collections, both public and private, from the same and other areas. In addition to typological data, significant distributional information is being accumulated for expanded treatment in a subsequent report.

The analysis of this large sample resulted in a remainder of 917 points (.084 percent of the total) which could not with certainty be attributed to the 27 types herein described. Some of the difficulty in typing the material arose from the lack, in certain specimens, of "crisp" diagnostic criteria or from the presence, in others, of typologically interlinking features. There were also a fair number of points too crudely made to render determinate the essential form and a much smaller number which showed obscuring secondary alterations.

From this untyped residue of 917 points can be extracted at least the three following small groups:

1. Bifurcated base points totaling 48 (plate 34)
2. A long, narrow, triangular form, with 35 examples (plate 35)
3. A broad-bladed, stemmed form, represented by 34 points (plate 36). Some of these resemble Snook Kill points and may be variants of that type. (See plate 27.)

The bifurcated forms, on the basis of scanty existing data, apparently cannot be unified by their prominent attribute of stem bifurcation. On the other hand, when the samples can be expanded and cultural and temporal data supplied, the triangular and broad, stemmed forms may become candidates for additional types.

There are left 800 points, from which can be isolated six or seven small lots. Each consists of a dozen or less points in which the similarity is sufficient to hint at type categories from future research.

In accounting for the others, it is likely, especially where the material as well as the form is exotic to the area, that an indeterminate number may be erratics from undescribed point groups of distant proveniences. (See plate 33.) Among the rest are a fair number of specimens that may plausibly be regarded as aberrant objects resulting from accidents of the chipping process, perhaps from technical difficulties with the material; from the artisan's caprice; or, perhaps, even from his experimental design, unique and unadopted, since the element of inventiveness must be admitted to account originally for some unknown portion of all point styles.

EXPLANATION

In the following descriptions the projectile point types are arranged alphabetically, in accord with the usual procedure. A single very typical specimen ("holotype") is reproduced natural size from a carefully made drawing showing details of the chipping characteristics, with descriptive text for each group. Following this, one or more photographic assemblages depicting the range in size and form of the type, are given, with data on provenience, material and ownership.

To aid the general student in identifying his own material, the point types are also listed below under two categories: (1) by major period provenience, table 1; and (2) by their principal morphological attribute characteristics, table 2. To more readily comprehend the latter, the standard terminology for projectile points is shown in the illustration, figure 1, on page 11.

Table 1
Major Period Provenience of Projectile Point Types

GENERAL PERIODS	PROJECTILE POINT TYPES	GENERAL PERIODS	PROJECTILE POINT TYPES
Late Woodland	Madison Levanna		Genesee Brewerton Eared-Triangle Brewerton Eared-Notched
Middle Woodland	Jack's Reef Pentagonal Jack's Reef Corner-Notched Snyders	Middle Archaic	Normanskill Brewerton Corner-Notched Brewerton Side-Notched Otter Creek Vosburg
Early Woodland	Adena Fulton Turkey Tail Meadowood	Early Archaic	Lamoka
	Steubenville Lanceolate (?) Steubenville Stemmed (?) Orient Fishtail	Paleo-Indian	Clovis
Transitional and Late Archaic	Susquehanna Broad Perkiomen Broad Rossville Bare Island Poplar Island (?) Snook Kill (?)		

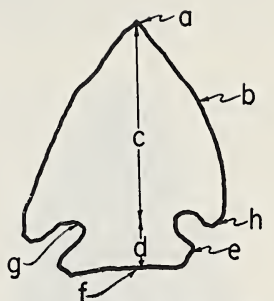
Table 2
Point Types Grouped by Primary Morphological Feature

Side-Notched Points Brewerton Side-Notched Brewerton Eared-Notched Fulton Turkey Tail Lamoka (in part) Meadowood Normanskill Otter Creek	Contracting Stemmed Points Adena Poplar Island Rossville Snook Kill
Corner-Notched Points Brewerton Corner-Notched Jack's Reef Corner-Notched Snyders Vosburg	Expanding Stemmed Points Orient Fishtail Perkiomen Broad Susquehanna Broad
Straight Stemmed Points Bare Island Genesee Lamoka (in part) Steubenville Stemmed	Stemless Points—Triangular or Lanceolate Brewerton Eared-Triangle Clovis Jack's Reef Pentagonal Levanna Madison Steubenville Lanceolate

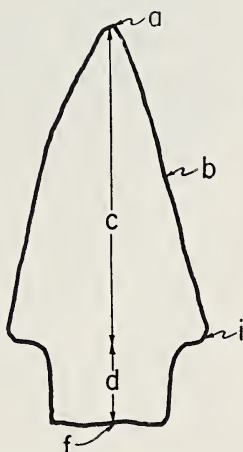
NEW YORK PROJECTILE POINTS



SIDE - NOTCHED



CORNER - NOTCHED



STRAIGHT STEMMED



CONTRACTING STEMMED



EXPANDING STEMMED



TRIANGULAR



LANCEOLATE

FIGURE 1—STANDARD PROJECTILE POINT TERMINOLOGY: a, point or tip; b, edge; c, blade or face; d, stem; e, tang; f, base; g, notch; h, barb; i, shoulder.

ADENA POINTS (plate 1)



General description: Large points with broad, lobate stems.

Size: According to Bell (1958, p. 4) most points of this type measure between 3 and 5 inches in length. In a sample of 50 from New York, the shortest was $1\frac{1}{16}$ inches, the longest 4 inches, with the majority falling between 2 and 3 inches. In thickness, the New York sample varied from $\frac{1}{4}$ to $\frac{7}{16}$ of an inch; nearly all, however, fell between $\frac{5}{16}$ and $\frac{3}{8}$ of an inch. Such points are generally considered dart points. Longer, probable spear points, also occur. (See e.g., Ritchie and Dragoo, 1960, plate 8, figure 6).

Proportions: For the most part, about two to two and one-half times as long as wide.

Shape: Blade generally ovoid in outline; some of the narrower specimens could be described as lanceolate; biconvex to nearly flat in cross section; edges excurvate. Shoulders weak to moderate in development, never barbed, sloping to approximately right angular in profile. Stem broad, long, contracted, lobate in outline, with convex, sometimes nearly pointed base. While stem grinding is reported for some Adena points, it is absent in the New York sample studied.

Age and cultural affiliations: This is the characteristic point style of the Adena culture, of Early Woodland times, radiocarbon dated between about 800 B.C. and A.D. 800. It is also a trait of the Middlesex complex in the Northeast, which is believed to have been derived in part from the Adena (Ritchie and Dragoo, 1959, pp. 43-50; 1960, p. 26ff.).

Kneberg says that "the type is also associated with the late Archaic culture in the Tennessee area, dating from about 1000 B.C. to the early centuries A.D." (Kneberg, 1956, p. 26.)

Distribution: "The Adena type is found chiefly in the upper Ohio River Valley, especially the states of Ohio, Kentucky, Indiana, West Virginia and Pennsylvania." (Bell, 1958, p. 4.) It has an uncertain peripheral distribution which includes Tennessee and New York.

NEW YORK PROJECTILE POINTS

References: Kneberg, 1956, pp. 26-27; Bell, 1958, pp. 4-5; Ritchie, 1958, pp. 100-102, where it is called a "lobate stemmed point"; Ritchie and Dragoo, 1960.

Remarks: In the upper Ohio Valley area Adena points are frequently made of Flint Ridge, Ohio chalcedony or of Harrison County, Indiana flint. Specimens made of these materials are also known from New York, but most New York examples are of regional flints—Onondaga, Oriskany, Helderberg, Normanskill, Deepkill, Fort Ann—or very rarely of quartz. These seem to be local copies, in readily available materials, but often on a somewhat smaller scale, of introduced Adena points.

BARE ISLAND POINTS (plates 2 and 3)

This description was prepared by W. Fred Kinsey III.



General description: Medium to large, finely flaked, symmetrical points, having slender isosceles triangular blades. The stem is straight with parallel sides and the base is also straight.

Size: They range from 1.2 inches to 3.8 inches long with the average length slightly over 2 inches. In cross section they are oval and relatively thick.

Proportions: Blade width is between $\frac{1}{2}$ and $\frac{1}{3}$ of the total length. A rather slender shape predominates, although extreme narrow-bladed examples are in the minority.

Shape: The blade exhibits considerable symmetry in the form of an isosceles triangle. Edges are generally slightly convex with the edges on the larger specimens tending to be straighter. Greatest convexity usually occurs at the middle of the blade. Tips are sharply pointed and are always on center with the stem although there is no distinct medial ridge. Points made of quartz are thicker than those fashioned from other lithic materials. Probably this is a function of the way quartz flakes, rather than a trait of cultural significance.

Shoulders are slightly rounded and tapered but not conspicuously so. On a few specimens the shoulders are quite sharply angled and well defined. An obtuse angle is formed between the blade and stem, but in some instances a right angle is present. There are intergrades between the Bare Island point and the Poplar Island point, but the rounded shoulder is conspicuous on the latter type. This is a distinguishing characteristic. The shoulder on the Bare Island point is more crisp.

The stem is always narrower than the blade. The long sides of the stem are parallel or nearly so forming a nearly perfect square or rectangle. The base is usually quite straight, but it is sometimes slightly convex. A few examples intergrade with a large corner-notched point form that has an expanded stem. There are often traces of grinding

along the stem edges and at the base. Corners approach right angles and on some specimens they are quite sharp.

Age and cultural affiliations: This is a distinctive point type found on numerous Archaic sites in the lower Susquehanna watershed. It is more abundant on the islands of the Susquehanna rather than the hilltop sites back from the river. Although not found as yet in any deeply stratified sites, it is the major point type in all levels at the Kent-Hally site on Bare Island. It is also abundant at the Fallen Tree site on the same island. The type is presumed to be part of a varied and complex Late Archaic. Locally, the author believes it is contemporaneous with steatite bowls.

Similarities between the Bare Island point and a component of the Accokeek Creek site on the lower Potomac River, south of Washington, D.C., are striking. It may be that the antecedent for this type lies in the Virginia and Carolina Piedmont and the Savannah River in Georgia.

Distribution: The type is found in the lower Susquehanna Valley, particularly the river islands. It extends southward along Elk River in Maryland, the Chesapeake and the lower Potomac. East of the Susquehanna, it is found along the headwaters of the White Clay Creek and the Brandywine in Chester County. West of the Susquehanna, it is not common in the Adams and Franklin County sections of the Cumberland Valley. The writer believes the distribution is also spotty along the west and north branches of the Susquehanna.

[The distribution of these points extends across New Jersey into southern and eastern New York. They occur in some abundance on Staten Island and Long Island, and with diminishing frequency northward up the Hudson Valley, at least to Saratoga County. The Ctl. 1 site in Greene County provided a sample of 114. In the southern part of this range, quartz is the commonest material. Farther north flint predominates, although quartz and quartzite are still present. (See plate 3). W.A.R.]

References: Kinsey, 1959, p. 115, where they are called "straight-stemmed, Type A."

Remarks: At the Kent-Hally site nearly 50 percent of these points were made of quartz. Other locally available stones in order of preference are: siltstone, quartzite, rhyolite, argillite, and a very few of flint, gneiss and schist. No attempt was made to utilize the available flint and jasper sources. The reasons for this cultural preference are unknown.

BREWERTON CORNER-NOTCHED POINTS (plate 4)



General description: Broad, thick, corner-notched points, predominantly of medium size.

Size: Length range from about $1\frac{5}{16}$ to $3\frac{1}{8}$ inches. Majority fall between $1\frac{1}{4}$ and $2\frac{1}{4}$ inches.

Thickness about $\frac{3}{16}$ to $\frac{3}{8}$ of an inch; majority about $\frac{5}{16}$ of an inch.

Proportions: These points are one and one-fourth to one and one-half times as long as wide. The larger examples are about twice as long as wide.

Shape: Blade trianguloid in outline, biconvex in cross section; edges slightly excurvate, less often straight, or rarely incurvate. Stem corner-notched with medium to large corner notches forming prominent barbs, and basally expanded. Base straight, slightly convex or rarely slightly concave. About two-thirds have the base ground smooth.

Age and cultural affiliations: This constitutes a minority point type in the Archaic Brewerton complex of Laurentian and in the Frontenac complex in New York. There is some evidence that it appeared later than the Brewerton Side-Notched type in the Brewerton complex. The Vosburg Point of the eastern New York manifestation of Laurentian differs from the Brewerton Corner-Notched type in its shorter stem, smaller notches and usually weaker barbs. The two forms overlap, however, and appear to be genetically related and generally contemporaneous.

Distribution: Primarily a central and western New York form. Present also in eastern New York with occasional examples as far south as central New Jersey. Similar points occur also as a minor and relatively late type on sites attributed to the Laurentian of the upper Ohio Valley (Dragoo, 1959, pp. 162, 176-180).

References: Ritchie, 1940, pp. 29, 48-49, 66, 88, where they are described as "corner-notched points." Subsequently the writer has referred to them as "broad corner-notched points."

Remarks: Usually made of local Onondaga gray flint and apparently in the same manner as the Brewerton Side-Notched form.

BREWERTON EARED-NOTCHED POINTS (plate 5)



General description: Generally broad, thick, weakly side-notched points, small to medium in size, characterized by a broad base with flanges which often project beyond the edges and, for the most part, have been carefully chipped into small and delicate prominences or "ears."

Size: The length range is from $\frac{3}{4}$ to $2\frac{1}{2}$ inches, the majority being between 1 and $1\frac{1}{2}$ inches long. Thickness $\frac{3}{16}$ to $\frac{5}{16}$ of an inch, with $\frac{1}{4}$ of an inch for most examples.

Proportions: About one and one-half to two times as long as wide.

Shape: Blade trianguloid or ovoid in outline, biconvex in cross section; edges prevailingly excurvate, less frequently straight. Stem broad, with small side notches and pronounced lateral, carefully chipped "ears." Ears and base, the latter in most instances slightly concave, occasionally straight, are sharp, except in a very few examples where they are ground smooth.

Age and cultural affiliations: A minority type in the Brewerton complex, where it constitutes 8 percent of the projectile point inventory at the Robinson site, but is barely represented at the nearby Oberlander No. 1 station. Present also as a minority form on Middle and Late Archaic period sites in eastern New York and southern New England.

Distribution: Central and eastern New York and southern New England, especially Massachusetts.

References: Ritchie, 1940, pp. 28, 66, where it is called the "eared notched point;" 1958, where it is referred to throughout as the "eared side-notched point."

Remarks: This point type was probably derived from the Brewerton Side-Notched type in upper Middle Archaic times. The material of the Brewerton series in central New York is Onondaga flint; of the eastern New York series, predominantly local flints.

BREWERTON EARED TRIANGLE POINTS (plate 6)



General description: Relatively thin, isosceles triangular points, small to medium in size, distinguished by small, delicately chipped "ears" on either side of the base.

Size: Only one site has produced a sizable sample of these points, the Robinson site at Brewerton, N.Y. As represented by the 60 such points at this site, the length range is from $\frac{7}{8}$ to $2\frac{1}{8}$ inches, the majority falling between $1\frac{1}{16}$ and $1\frac{1}{2}$ inches.

Proportions: About one and one-half to two times as long as wide.

Shape: Blade trianguloid or ovoid in outline, biconvex in cross section; edges prevailingly excurvate, occasionally straight. Stemless, base broad and slightly concave or infrequently straight. Very delicately chipped "ears" occur on either side of the base, which in some examples has been rubbed smooth.

Age and cultural affiliations: Like the evidently related Brewerton Eared-Notched point, this is a minority type in the Brewerton complex, where it comprises only 5.38 percent of the total point series at the Robinson site, and is barely represented at the nearby Oberlander No. 1 site. It also occurs occasionally in eastern New York sites of the Laurentian tradition and in related sites of southern New England. The author regards it as a type of the upper Middle and Late Archaic horizons in these several areas.

Distribution: Central and eastern New York and southern New England, especially Massachusetts.

References: Ritchie, 1940, pp. 32, 67, where it is described as the "eared-triangular point."

Remarks: This type intergrades with the Brewerton Eared-Notched type and may well have developed from it. Most examples from the Brewerton sites are of local flints, carefully made by pressure flaking techniques.

BREWERTON SIDE-NOTCHED POINTS (plate 7)



General description: Broad, thick, side-notched points, predominantly of medium size.

Size: Length range from about $1\frac{3}{16}$ to $3\frac{7}{8}$ inches, prevailing between $1\frac{1}{4}$ and $2\frac{1}{4}$ inches.

Thickness about $\frac{1}{4}$ to $\frac{1}{2}$ inch; $\frac{5}{16}$ to $\frac{3}{8}$ of an inch for the large majority.

Proportions: These points are one and one-fourth to one and one-half times as long as wide. The larger examples are about twice as long as wide.

Shape: Blade trianguloid in outline, biconvex in cross section; edges slightly excurvate, straight, or rarely incurvate; faintly serrated in rare instances. Stem side-notched (occasionally with dual notches) and basally expanded, sometimes to a pronounced degree, resulting in lateral projections or "ears." Base straight, slightly convex or less often mildly concave. About two-thirds of all specimens have the base ground smooth.

Age and cultural affiliations: This is the commonest point of all Archaic Laurentian complexes of New York.

Distribution: All of New York. Also a dominant type on upper Ohio Valley sites attributed to the Laurentian (Dragoo 1959). It is a minority type on certain southern New England Archaic sites and is present in Laurentian and Laurentian-like contexts in southern Ontario, Pennsylvania and elsewhere in the Northeast.

References: Ritchie, 1940, pp. 28, 64-66, where they are termed "side notched points." In later reports the writer has called them "broad side-notched points."

Remarks: These points probably were, for the most part, javelin heads. The larger sizes seem to have been spearpoints, while the smaller variety could apparently have served as arrowpoints. It is, however, unlikely that the bow and arrow was a hunting device at the period, probably from around 3000 B.C. to early A.D. when this type of point seems to have been used. Some of the more convex

edged specimens, especially those with short blade, were likely knives. Rechipping to sharpen may account for some of the short-bladed examples (plate 7, figure 8) and this process would accentuate the proportions of the base.

For the most part these points seem to have been manufactured by percussion chipping from local flints. Pressure flaking to produce a sharp retouched edge is common.

The Brewerton Side-Notched point is probably related to the Otter Creek point (plate 20 and pp. 40-41 herein), the Black Sand Notched (Scully, 1951, p. 10), the Big Sandy Side-Notched (Kneberg, 1956, p. 25), and other forms, including very similar examples from the Shell Mound complex of the Southeast. The writer suspects it is genetically related to other very old and widely-distributed, side-notched, American projectile points.

CLOVIS POINTS (plate 8)



General description: Narrow, fluted, lanceolate points, of medium to large size, with concave bases.

Size: Length range from about 1 to 5 inches. The majority, in a series of 66 such points from New York State, measure between about $2\frac{1}{2}$ and $3\frac{1}{2}$ inches in length, and between $\frac{3}{16}$ and $\frac{5}{16}$ of an inch in maximum thickness (range $\frac{1}{8}$ to $\frac{3}{8}$ of an inch).

Proportions: Two to four times as long as wide.

Shape: Lanceolate, with parallel or ex-curved edges and concave base. Basal and lower lateral edges usually ground smooth. Both faces (rarely only one) fluted, the channel scars extending for varying distances on either side from base to tip. Frequently more than one channel flake was struck off on each face.

Age and cultural affiliations: Early paleo-Indian. Recent radiocarbon dates from

the Lehner site, a mammoth kill site in southeastern Arizona with Clovis points, indicate an antiquity of 11,000 to 12,000 years (Haury, Sayles and Wasley, 1959, pp. 24-25) for the Llano complex to which the Clovis point type has been assigned, at least in the western United States (Sellards, 1952, pp. 17-18).

Carbon 14 dates averaging about 9,000 years ago have been obtained for the Bull Brook site in northeastern Massachusetts (Byers, 1959), where Clovis type points comprise part of a paleo-Indian chipped stone tool complex, having parallels elsewhere in the eastern United States.

Distribution: Chiefly as surface finds without faunal or cultural associations, the Clovis point is widely distributed throughout the United States and southwestern Ontario. Definite components, with faunal associations, mainly mammoth remains, have been found in the American Southwest and High Plains; without faunal associations

in the eastern United States from Tennessee to Vermont. Sporadic point occurrences are known from Mexico, western Canada and Alaska.

References: Wormington, 1957, pp. 42-84; Sellards, 1952, pp. 17-46; Suhm, Krieger and Jelks, 1954, p. 412; Ritchie, 1957; Bell, 1958, p. 16.

Remarks: Clovis points are generally skillfully and carefully made, apparently by pressure flaking techniques. The stone material is usually a high grade mineral which frequently is exotic to the area where the points are found.

The Clovis type point should not be confused with the Folsom type, which is also fluted, and which has a much more limited distribution within the western part of the United States. The Folsom type, which at the Blackwater No. 1 locality, New Mexico, has been found stratigraphically above the Llano complex containing the Clovis type, was probably developed from it by paleo-Indian groups in the High Plains who hunted bison of now extinct species (Sellards, 1952, pp. 29-31). A radiocarbon date of $9,883 \pm 350$ years ago has been determined for a Folsom component near Lubbock, Texas (Sellards, 1952, pp. 52-55).

The Folsom point is described by Wormington (1957, p. 263) as "A more specialized type, of excellent workmanship, thought to be derived from the Clovis type. There is some overlap in size between Clovis and Folsom points, but the latter are lighter and usually smaller. They range in length from three quarters of an inch to three inches with an average of about two inches. They are lanceolate in outline and have concave bases usually marked by ear-like projections. There is frequently a small central nipple in the basal concavity. The points were fluted through the removal of longitudinal flakes. The flutes usually extend over most of the length of the point. In most cases one major channel flake was removed from each face, but sometimes only one face was fluted. Most specimens have a fine marginal retouch. The lower edges usually bear evidence of grinding."

FULTON TURKEY TAIL POINTS (plate 9)

Although probably a knife blade rather than a projectile point, this type is listed and described in Scully's paper on projectile point typology (Scully, 1951, p. 11). A small number of specimens have been found in New York, chiefly in the central part of the State, in the Seneca and Oneida Rivers region.

The following description, except for the few New York specimens available, is taken from Scully (*op. cit.*).

"Material: Chipped stone. [All examples of this type seen by the writer were made from Harrison County, Indiana, gray or blue-gray nodular flint. The surface-found New York specimens have weathered to a tan or brown color, the lighter concentric rings in the mineral sometimes weathering almost white. The flaking was very skillfully accomplished by a pressure technique which left broad, flat scars. Fine marginal retouching is universally present.]

"General description: Leaf shaped, pointed at both ends and side notched at one end.

"Size: Average—about 6 inches. [The New York examples range from $3\frac{3}{4}$ to 6 inches long and average $\frac{1}{4}$ of an inch in maximum thickness.]

"Proportions: Three times as long as the widest point.

"Shape: Body—pointed at both ends with widest portion halfway up the length of point.

Notches—shallow, rounded, narrow, side notches located about $\frac{1}{10}$ length from end of point.

"Variants: Proportions vary as do the position of the notches.

"Association: Usually with late Archaic or early Woodland. [A specimen of this kind was found by the writer in a grave of the early Point Peninsula complex, Early Woodland period, on the Oberlander No. 2 site at Brewerton, Oswego County, N.Y. (See Ritchie, 1944, pp. 152-160, plate 71, figure 13. Slight damage to the base of this artifact has resulted in the loss of the characteristic point.) Charcoal from one of the burials, all cremated, in this cemetery, yielded a radio-carbon date of 998 B.C. $\pm$ 170 years (Chicago sample No. 192. Arnold and Libby, 1951, p. 114).

It is a diagnostic trait of the Red Ocher culture of the upper Great Lakes region.]

"Distribution: Central Illinois, eastern Missouri, and southern Illinois and Indiana. [To this range we may add Ohio and central New York.]

"Reference: Titterington, 1950." [Scully, 1951, p. 11.]

GENESEE POINTS (plate 10)



General description: Large, thick, straight stemmed points, of medium breadth.

Size: Length range is from approximately $1\frac{1}{2}$ to 6 inches; the majority falling between 3 and $3\frac{1}{2}$ inches. Specimens longer than 6 inches occasionally occur or are indicated by broken basal sections. Thickness varies from about $\frac{5}{16}$ to $\frac{9}{16}$ of an inch, with most points measuring between $\frac{3}{8}$ and $\frac{7}{16}$ of an inch.

Proportions: Typically about 2 to $2\frac{1}{2}$ times as long as wide.

Shape: Blade trianguloid in outline, markedly biconvex in cross section; edges straight or slightly excurvate. Stem rectangular and straight or parallel-sided. Shoulders weakly to moderately developed, with straight or slightly oblique basal edge. Base straight. About 40 percent show slight grinding of base and sides of stem.

Age and cultural affiliations: Apparently Middle to Late Archaic; part of Laurentian and Frontenac manifestations. Examples were found among the grave goods of 9 burials at Frontenac Island (Ritchie, 1945, pp. 48-80). Radiocarbon dates at this site range from 2980 B.C. $\pm$ 260 (C-191, Arnold and Libby, 1951, p. 114), through 2013 B.C. $\pm$ 80 (Y-459), to 1723 B.C. $\pm$ 250 (W-545).

Distribution: Central and, particularly, western New York and westward across the Niagara Peninsula of Ontario. Especially numerous in the Genesee Valley of New York and the Grand River Valley of Ontario. To a much lesser extent they occur also in eastern New York and southern New England.

References: Ritchie, 1940, p. 29; 1945, p. 30, where they are referred to as "stemmed" and "broad stemmed" points, respectively.

Remarks: Genesee points seem to have served as dart or spear points, perhaps in a few cases as knives. A very large percentage are made from the characteristic mottled gray and brown flint of the Onondaga escarpment of western New York and adjacent Ontario, most of the remainder being of the more uniform gray Onondaga chert of central New York.

Broad, shallow chipping scars suggest percussion technique of manufacture. Marginal retouching is evident in many specimens and probably signifies pressure work.

These points bear a marked similarity to the Kays Stemmed, a Middle to Late Archaic type of the Tennessee area (Kneberg, 1956, p. 26), and to straight stemmed points from the Shell Mound complex of Kentucky (compare, e.g., with figure 32, A. Webb, 1946).

JACK'S REEF CORNER-NOTCHED POINTS (plate 11)



General description: Broad, thin, corner-notched points of medium size, frequently having angular edges.

Size: Length range from about 1 to $2\frac{1}{4}$ inches; for the most part, between $1\frac{3}{4}$ and 2 inches. Maximum thickness $\frac{3}{16}$ to $\frac{1}{4}$ of an inch, the majority do not exceed the minimum figure. There is one larger specimen, probably a spearhead of this type, measuring 4 inches in length, but only $\frac{5}{16}$ of an inch in thickness (plate 33, figure 2).

Proportions: About one and one-fourth times as long as broad.

Shape: Ovoid or pentagonal in outline, and flat or nearly so in cross section. Edges excurvate or angular. Stem corner-notched and basally flaring, barbs small to large, thin and sharp. Base straight, and occasionally slightly smoothed.

Age and cultural affiliations: Later Middle Woodland times and the earlier part of the Late Woodland period.

Its principal period of use in New York encompassed Point Peninsula 2 and 3 complexes and the early Owasco Carpenter Brook complex. One site of the latter complex (White site, Norwich, N.Y.) has been radiocarbon dated at A.D. 905 ± 250 years (M-176, Crane, 1956, p. 668).

It appears to be one of the forms found in the Intrusive Mound culture graves at the Mound City Hopewell group in Ross County, Ohio (Mills, 1922, p. 579 and figure 94).

Distribution: A major center of use was the Seneca River area of central New York, where it has been found in the burials and/or refuse of the Kipp Island, Jack's Reef, Bluff Point, Wickham and other sites, and on much more numerous surface sites. It is sporadically distributed in western, northern and eastern New York. As already mentioned, it occurs in Ohio, which was probably a primary center of dispersal into New York.

NEW YORK PROJECTILE POINTS

References: Ritchie, 1944, pp. 132 ff., plate 59, figures 8, 14-18, 20, 22-25; p. 173, plate 77, figures 6-8; 1946, p. 20, plate 6, figure 23; 1958, plate 14, figures 5, 6. According to blade outline, the point is alluded to in these references as "broad corner-notched" or "corner-notched with angular edges."

Remarks: This point takes its name from the late Point Peninsula Jack's Reef site in Onondaga County, N.Y., excavated by the writer in 1947 and 1951 (ms. report on file at New York State Museum and Science Service).

Materials include not only central New York Onondaga flint, but eastern Pennsylvania jasper and Flint Ridge, Ohio chalcedony. The points appear to have been made by carefully controlled pressure flaking.

JACK'S REEF PENTAGONAL POINTS (plate 12)



General description: Broad, stemless, pentagonal points.

Size: Range in length from 1 to $1\frac{3}{4}$ inches; majority measure between $1\frac{1}{4}$ to $1\frac{1}{2}$ inches, with a maximum thickness of $\frac{3}{16}$ of an inch.

Proportions: About one and a third times as long as wide.

Shape: Pentagonal, usually with straight sides. Sides, however, may be slightly contracting. Base straight, rarely concave.

Age and cultural affiliations: A larger, thicker and cruder variant (up to $2\frac{1}{4}$ inches long) appears in the Brewerton complex (Middle Archaic). A few smaller, but still crude, examples occur in the middle or Point Peninsula 2 complex (later Middle Woodland). It constitutes a minor, but well-executed form on late Point Peninsula (Point Peninsula 3), and especially on sites which show transitional features into the early Owasco (lower Late Woodland) complex, where it continues, however, as a minor point type. The best example is the White site, near Norwich, Chenango County, N.Y., radiocarbon dated at A.D. 905 ± 250 years (M-176, Crane, 1956, p. 668).

Like the Jack's Reef Corner-Notched point, with which it coexists on both Point Peninsula and Owasco sites in New York, it was present in the Intrusive Mound culture graves at the Mound City Hopewell group in Ross County, Ohio (Mills, 1922, p. 579 and figure 94).

References: Ritchie, 1940, pp. 30-31; 1944, pp. 89, 107, 133; 1946, p. 39. They are termed "pentagonal-shaped points" in these references.

Distribution: Very similar to the Jack's Reef Corner-Notched type. In central and eastern New York it has been found in refuse and/or burials on the Robinson, Wickham, Jack's Reef, Kipp Island, Bluff Point, White and Schermerhorn sites.

It occurs, as mentioned, in Ohio. A similar form is described for Virginia (Holland, 1955, pp. 167-168).

Remarks: Named from the late Point Peninsula Jack's Reef site in Onondaga County, excavated by the writer in 1947 and 1951 (ms. report on file at the New York State Museum and Science Service).

Materials, local flints. Technique, pressure flaking.

LAMOKA POINTS (plates 13 and 14)



General description: Small, narrow, thick points, with weak to moderately pronounced side notches, or straight stemmed with slight, usually sloping shoulders.

Size: The length ranges from less than one inch to about $2\frac{1}{2}$ inches. The majority fall between $1\frac{1}{4}$ and $1\frac{3}{4}$ inches in length, and measure about $\frac{1}{4}$ of an inch in maximum thickness. There are a few longer points, believed to be spearheads, which range up to $5\frac{3}{8}$ inches in length. (Ritchie, 1932, plate V, figures 28-30.)

Proportions: Two to three times as long as wide.

Shape: Blade trianguloid in outline, biconvex or median ridged in cross section; edges straight or slightly excurvate. Stem straight and of moderate length or side-notched. Base straight, oblique, or slightly convex, usually unworked and as thick as blade, often exhibiting broad, unmodified surface of flake or pebble from which point was made. This thick, "unfinished" condition of the base is a prime diagnostic feature of the Lamoka point wherever found.

Age and cultural affiliations: The characteristic point form of the Lamoka complex, for which radiocarbon dates ranging from about 3500 B.C. to 2500 B.C. have been obtained. Both the side-notched and stemmed forms occur together in the same Lamoka components at the same levels, although the proportions vary somewhat from site to site, as noted in the site reports. The type apparently persisted in very minor proportions down to Middle Woodland times, at least in central New York.

Distribution: This type has a wide range beyond the known area of the defined Lamoka complex in central and western New York and adjacent northern portions of Pennsylvania. To the west it is found on the Niagara Peninsula of Ontario, and a very similar form, called the "Dustin point," is well represented in the Lower Peninsula of Michigan. (Data received from, and specimens seen through the courtesy of Lewis R. Binford, Museum of Anthropology, University

of Michigan.) East of the Lamoka culture area it is present in eastern and southeastern New York and it has a still broader random distribution.

References: Ritchie, 1932, pp. 91-92; 1936, pp. 4-5; 1944, p. 329; 1945, p. 30; 1958, pp. 14, 31-33, 45-46, 60-61; 1959, pp. 84-85, 87-89; Dragoo, 1959, p. 238. (Ritchie has referred, in the later references, to two types, viz., Lamoka Side-Notched and Lamoka Stemmed, herein described as a single type.)

Remarks: Lamoka points seem usually to have been made from local materials, principally flints, quartz or quartzite. A pebble industry was indicated at the Lamoka Lake site. The chipping is generally coarse and marginal retouching is rare. Binford has distinguished two methods of making these points, the more common being lamellar chipping from either edge to produce a medially ridged blade. This is the only method reported by him for the "Dustin" points from Michigan.

The second method has resulted in flatter, randomly placed flaking scars, and a biconvex rather than a rhomboidal cross section for the blade. He regards this distinction as of possible chronological significance. (By conversation of November 1959.) Should his hypothesis be sustained, the writer suggests use of the terms Lamoka B and Lamoka A, respectively, for these groups.

It would seem that Lamoka points constitute a relatively early Archaic horizon style in the New York area.

LEVANNA POINTS (plate 15)



General description: Medium to large, fairly thin, triangular points, generally with concave bases.

Size: In the sample of 250 New York points used in this study, the length range was $\frac{7}{8}$ to 3 inches. The majority measured between $1\frac{1}{4}$ and $1\frac{3}{4}$ inches in length and $\frac{3}{16}$ of an inch in maximum thickness.

Proportions: Characteristically these points are nearly as broad as they are long. In the more slender examples the length varies from about one and one-third to one and one-half times the breadth.

Shape: Approximately 70 percent are equilaterally triangular. The rest may best be described as broad isosceles triangles. Edges usually straight, occasionally incurvate, recurvate, or slightly excurvate. More than 80 percent have a basal concavity, often to a marked degree, nearly V-shaped in a few examples, producing prominent corner barbs, which are occasionally asymmetric (plate 15, figures 5 and 10). The remainder have straight bases.

Age and cultural affiliations: In New York State this type evidently made its appearance in late Middle Woodland times around A.D. 700. It did not, however, become common until the transitional period into Late Woodland, ca. A.D. 900. Thereafter its popularity rapidly increased, until it became the principal Late Woodland point type over much of the area. Around A.D. 1350 it began to be supplanted by the Madison type, mainly in the districts of Iroquois cultural domination.

The Levanna point is associated as a minor type with the middle and late Point Peninsula complexes. It is the characteristic type of the Owasco of all stages of development. On the same time level as Owasco it is an important type in the Bowmans Brook, Clasons Point and Sebonac cultures of coastal New York. It appears in significant proportions in various late prehistoric manifestations of southern New England, New Jersey and Pennsylvania.

Distribution: New York, much of New England, southeastern Ontario, the Middle Atlantic area, at least to Virginia, and eastern Pennsylvania.

References: Named from the Levanna site, Cayuga County, N. Y. (Ritchie, 1928).

Remarks: Unquestionably an arrowpoint. Very finely chipped by pressure flaking. Materials local flints, jasper, quartz and quartzite.

MADISON POINTS (plate 16)



This point type was described by Scully as the Mississippi Triangular Point, later changed by him to the Madison Point (Scully, 1951, p. 14. The copy received from him contains the penciled nominal revision). He gives the association as "Middle Mississippi," and the distribution as "Middle and Upper Mississippi sites in Illinois, Wisconsin and Missouri."

Kneberg refers to a very similar point as the "Late Mississippi Triangular," but confines it to a form with "straight basal edge" (Kneberg, 1956, p. 24). She relates it to "most of the late Mississippi cultures in Tennessee," including the historic Cherokee, of the period of approximately A.D. 1300-1800. Her "Hamilton Incurvate" type, assigned to several cultures of the Late Woodland period, dating between c. A.D. 500-1000, exhibits the incurvate edges and base found on some of the points included in Scully's description as variants of the Madison type. (Kneberg, *ibid.*)

Suhm, Krieger and Jelks (1954, pp. 504, 498, 506) have defined various triangular types—the Maud, Fresno and Starr—which have features overlapping with the Madison type. These belong to assemblages which flourished during the latter half of the Christian era, and included pottery and agriculture.

The New York specimens herein described have some definite similarities to all of these possibly interrelated types. Since, however, the variations noted in our sample are readily accommodated within the compass of Scully's Madison type this name has been applied.

General description: Small, thin, triangular points.

Size: According to Scully, the length range is from $\frac{1}{2}$ to $2\frac{3}{8}$ inches, with an average of 1 inch. A New York sample of 100 points from a single prehistoric Iroquois site in western New York (plate 16) ranged from $\frac{3}{4}$ to $1\frac{9}{16}$ of an inch, with a majority falling between 1 and $1\frac{1}{4}$ inches. The thickness varied from $\frac{1}{16}$ to $\frac{3}{16}$, most of the specimens measuring $\frac{1}{8}$ of an inch, maximum.

Proportions: These vary from about as long as wide in the nearly equilateral specimens to twice as long as wide in the isosceles triangles, with most of the latter around $1\frac{1}{2}$ times as long as broad.

Shape: Equilateral (20 percent) or isosceles (80 percent) in outline, with straight (47 percent) or concave (53 percent) base (in two examples the base is slightly convex), and straight (75 percent), slightly excurvate (17 percent), or slightly incurvate (8 percent) edges. Flat or nearly so in cross section.

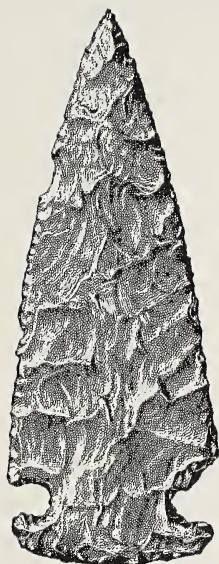
Age and cultural affiliations: Late prehistoric to early historic period. Constitutes, in varying proportions, an arrowpoint type of many Middle and Upper Mississippi and Late Woodland complexes. In the Northeast it is the distinctive Iroquoian form.

Distribution: Has a wide distribution in the eastern United States and southeastern Ontario.

References: Scully, 1951, p. 14.

Remarks: Very finely chipped by pressure flaking. Among the northern Iroquois the principal material employed was Onondaga flint from the exposures of central New York and the Ontario Peninsula.

MEADOWOOD POINTS (plate 17)



General description: Very thin, medium to large, side-notched points, of medium breadth.

Size: In length these points range from about $1\frac{5}{8}$ to $3\frac{1}{2}$ inches, with the majority falling between $2\frac{1}{4}$ and $2\frac{3}{4}$ inches. The thickness, even of the largest points, rarely exceeds $\frac{3}{16}$ of an inch.

Proportions: The length averages approximately two and a half to three times the breadth.

Shape: Blade trianguloid in outline, flat in cross section; edges are straight, slightly excurvate or incurvate, and are occasionally serrated or steeply beveled from opposite sides. Stem neatly side-notched, sometimes with double notch. Base straight or convex, sometimes expanded in fan shape,

or beveled to scraper edge. In about 50 percent base is ground smooth.

Age and cultural affiliations: This is the characteristic point type of the early Point Peninsula (Point Peninsula 1) complex, radiocarbon dated between about 2448 B.C. (C-794, Libby, 1954, p. 137) and 563 B.C. (M-640, Crane and Griffin, 1959, p. 183). It is apparently diagnostic for this Early Woodland culture.

Distribution: Northern, central and western New York and westward across the Niagara Peninsula of southeastern Ontario. Sporadically found in eastern and southern New York, and in the upper Allegheny Valley of western Pennsylvania.

References: Ritchie, 1944, pp. 122, 125-126, 152-160; 1955, pp. 48-49, where they are termed "thin side-notched" points; 1958, p. 68, where the type is referred to as "Meadowood Side-Notched."

Remarks: While most specimens appear to be projectile points, others seem to have been made or modified for use as side or end scrapers, knives, and perhaps saws. Many could have been manufactured by

slight alteration from the numerous mortuary or "cache" blades found in burials of this culture. The flat, well-controlled pressure flaking, shows great skill. Wherever found, these points (and the accompanying mortuary blades, drills and scrapers) are prevailingly of the peculiar mottled gray and brown flint of the Onondaga exposures in western New York and the Ontario Peninsula, or of the clear gray flints of the central New York Onondaga escarpment.

NORMANSKILL POINTS (plate 18)



General description: Slender, thick points of medium size, with prominent side notches.

Size: Length range from about $1\frac{7}{16}$ to $2\frac{3}{4}$ inches, majority fall between $1\frac{5}{8}$ and 2 inches. Thickness from $\frac{3}{16}$ to $\frac{3}{8}$ of an inch, in the majority the maximum thickness is $\frac{1}{4}$ of an inch.

Proportions: Two to three times as long as wide.

Shape: Blade narrow and triangular in outline, markedly biconvex in cross section; edges straight. Stem boldly side-notched and slightly thinned by coarse flaking from the base. Base straight or very slightly concave. Rarely the base shows a little smoothing.

Age and cultural affiliations: Occurs in varying proportions on sites or site components of Middle Archaic age. Constitutes an element of the Vosburg complex, Laurentian tradition.

Distribution: Eastern New York, chiefly along the Hudson River and tributary streams, such as the Normanskill, Mohawk River and Hoosic River, from about Glens Falls to Kingston. Excavated from the Harris site (Scv 1-2), Saratoga County, and from Stratum 3 of the Lotus Point site (Crl 3-1), Greene County. The dominant point form on the river site (Coh 8-3), Saratoga County. Abundant on the Vosburg site, Albany County.

References: Ritchie, 1958, pp. 8-53, plate 3, figures 23-33; plate 12, figures 9, 10; plate 15, figures 11-58, where they are described as "narrow side-notched points."

Remarks: This point suggests a slender variant of the Brewerton Side-Notched type which, described as "broad side-notched" by the writer (1958), occurs with it on the aforementioned eastern and other New York sites. Morphologically it is transitional between the Lamoka side-notched and Brewerton side-notched forms.

The materials used are local flints. The techniques employed in fabrication seem for the most part to have been percussion for the rough shaping of the point and pressure flaking to produce the varying amounts of marginal retouching.

ORIENT FISHTAIL POINTS (plate 19)



General description: A slender, gracefully formed point, of medium size, with characteristically narrow, lanceolate blade merging into a flaring "fishtail" stem.

Size: Length range from about $1\frac{3}{16}$ to 4 inches, predominantly 2 to $2\frac{1}{2}$ inches. Maximum thickness $\frac{3}{16}$ to $\frac{7}{16}$ of an inch, majority fall between $\frac{1}{4}$ and $\frac{5}{16}$ of an inch.

Proportions: These points are two and one-half to three and one-half times as long as wide.

Shape: Blade lanceolate in outline, biconvex to nearly flat in cross section; edges excurvate. Sloping shoulders merge into flaring stem with incurvate or less often, straight base. Latter occasionally slightly smoothed.

Age and cultural affiliations: Late Archaic and Transition period into Early Wood-

land. The characteristic point type of the Orient complex on Long Island and of a related manifestation with stone vessels in the Hudson Valley and elsewhere. Orient complex radiocarbon dated between 1044 B.C. $\pm$ 300 years (M-586) (Crane and Griffin, 1958, p. 1101) and 763 B.C. $\pm$ 220 years (W-543). (Ritchie, 1959, pp. 47-49, 74-76.)

Distribution: Eastern and southern New York, particularly the middle and lower Hudson Valley and Long Island. Has a light, sporadic representation in central New York, southern New England and northern and central New Jersey.

References: Ritchie, 1944, p. 227 ff.; 1958, esp. pp. 29-31, on the stratigraphic position of these points on a Hudson Valley site; 1959, on the Orient complex. Formal description under same name in latter, pp. 31-32.

Remarks: In the Orient complex of Long Island, a majority of these points were made, apparently by indirect percussion, from the local quartz or quartzite pebbles. Elsewhere regional flints of good quality or occasionally jasper or even slate were employed, and the flat flaking scars suggest reduction from a thick spall by a pressure technique.

OTTER CREEK POINTS (plates 20, 21, 22)



General description: Large, thick, narrow or medium wide, side-notched points, with "square" tangs.

Size: Length range from about $2\frac{1}{4}$ to $4\frac{1}{2}$ inches, majority fall between $2\frac{3}{4}$ and $3\frac{1}{2}$ inches. A few probable spearpoints of larger size have been identified (plate 22). Thickness range $\frac{5}{16}$ to $\frac{1}{2}$ inch, majority measure between $\frac{5}{16}$ and $\frac{7}{16}$ of an inch.

Proportions: Two to three times as long as wide.

Shape: Blade ovoid or lanceolate, rarely trianguloid in outline, biconvex in cross section; edges excurvate, less often straight; stem side-notched, notching seems to have been final operation, resulting in "square" tangs. Base concave or less frequently straight. Almost invariably the base and tang edges have been ground or rubbed smooth, and in nearly all cases this treatment has been extended to the notch.

Age and cultural affiliations: The prevailing point type of certain, still undescribed sites, apparently to be attributed to the poorly defined Vergennes complex of the Archaic Laurentian manifestation in western Vermont (Ritchie, 1944, pp. 253-257).

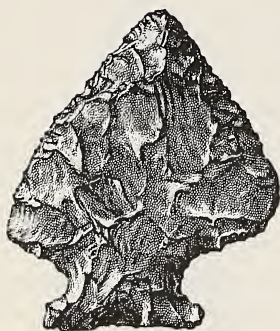
Distribution: As currently known, west central Vermont, especially the valley of Otter Creek and its tributaries. The predominant point form on certain sites explored by Thomas E. Daniels, Orwell, Vt. (plate 20); present also on the multicomplex Vergennes site (Bailey, 1939) and several other stations in this area. A cross tie with the Brewerton complex in central New York is afforded by the occurrence of a few points of this type on the Robinson site (Ritchie, 1940, plate 13, figure 97) and, conversely, of Brewerton type side-notched, corner-notched and eared-notched types on the Vermont sites in question.

An occasional point of this type is found on Archaic sites in eastern New York (plate 21).

References: None.

Remarks: The author believes the Otter Creek point is genetically related to the Brewerton Side-Notched point and to other similar types mentioned under the description of the latter (page 72). Side-notched points apparently very like Otter Creek points are reported from levels 5 and 6 of the Graham Cave site in Missouri (Logan, 1952, plate V, G-L; plate VI, A, B), and from the Osceola site of the Old Copper culture in Wisconsin (Ritzenthaler, 1946, plate 6; Bell, 1958, p. 68). Because of its large size it may have been primarily a spearpoint. The material of many of these points is a regional quartzite or metamorphosed siltstone or slate. Some, however, are of native or probably eastern New York flints. The chipping seems to have been done by percussion with secondary marginal pressure flaking on most examples.

PERKIOMEN BROAD POINTS (plate 23)



Witthoft is responsible for the definition of this type which he has termed the "Perkiomen Broad Spearpoint." The following discussion is based largely on his paper, cited below.

General description: "Very broad, boldly flaked spearpoints of semi-lozenge shape, with certain characteristic contour details often exaggerated."

Size: "Rarely less than two inches long and rarely more than four. Specimens up to nine inches long are sometimes found, and I have seen some examples four inches broad and six long."

A small New York sample ranged between $\frac{1}{4}$ and $\frac{5}{16}$ of an inch in thickness, with most examples in the lower range. The average thickness of this type slightly exceeds that of the Susquehanna Broad type.

Proportions: "Generally half as broad as long, or more. Rarely narrow, often very asymmetrical."

Shape: "Blade: Generally approximates an equilateral triangle, with convex edges near tip, and often slight convexity or concavity elsewhere. Blade edges are frequently asymmetrical, and the blade is often somewhat out of center in relation to the tang. Blades are thin, with rarely any medial ridge; where one occurs on one face, the other face is usually flat.

"Ears [Shoulders]: Frequently barbed, sometimes at both ears but more often only at one corner. The ears may form either obtuse or acute angles, but even strongly barbed specimens rarely have very acute ears. Edges in the ear area are always thin and sharp, and were carefully retouched to straight, even edges. Often the blade edge ahead of the ear is somewhat concave or convex. Chipping details of the ears and of the blade are like those of the Susquehanna Broad Spearpoint, but the breaks in contour of the edge are frequently very pronounced in the Perkiomen type, and the barbs and grotesquely turned corners are exaggerations of these shape details. The two edges of a specimen rarely show strong symmetry.

“Tang [Stem]: Always constricted and almost invariably with a convex base; the base is sometimes straight but is almost never concave. [In about half of the New York specimens the base is straight.] The tang is unusually small compared with the blade, and frequently is tiny in proportion to the rest of the spear. The tang corners are rounded, not prominent, and never suggest barbs. All edges of the tang are always ground smooth, including the basal corners of the tang. [This does not apply to many of the New York specimens.] This edge grinding extends out onto the ears only a short distance, generally to a conspicuous break in outline.”

Age and cultural affiliations: Probably like the Susquehanna Broad point, i.e., of the Transitional period from Late Archaic into Early Woodland. Witthoft has hypothesized that “The Susquehanna Broad Spear type appears to be the ancestor of the Perkiomen Broad Spear and the Lehigh Broad Spear [probably related to the Snook Kill point, here-in described, see pp. 47-48] types, . . . as well as of slightly different broad types of central New York and of the Hudson-Mohawk. . . . These derived types are, I believe, both later than and contemporary with the Susquehanna Broad Spear type; at any rate, they are overlapping ages and there do not seem to be any very significant time differences among them. Distributions are more geographic than temporal.” (Witthoft, 1953, p. 16.)

Distribution: The Schuylkill Valley and its tributary streams entering from the north, the eastern borders of the Susquehanna Valley, the Delaware and Hudson Valleys. Sporadically distributed in northern and central New Jersey and in the Mohawk, Seneca, and Genesee Valleys of New York.

References: Witthoft, 1953, pp. 16-20.

Remarks: The commonest lithic material of these points is Pennsylvania jasper, usually of the finest grades. Other specimens are of rhyolite; Onondaga flint from central and western New York; Deepkill and Normanskill flint from the Hudson Valley; Flint Ridge, Ohio chalcedony; and rarely, argillite or quartzite.

POPLAR ISLAND POINTS (plates 24 and 25)

This description was prepared by W. Fred Kinsey III.

General description: Medium to large, finely flaked, symmetrical points, having quite slender isosceles triangular blades. Shoulders are rounded and the constricted stem tapers toward a narrow rounded base.

Size: They range from 1.8 inches to 3.4 inches with the average length slightly over 2 inches. In cross section they are usually oval with some examples rather thin and flat.

Proportions: Generally they are more slender than Bare Island points. Blade width in comparison to length is narrow except where some specimens have rechipped blades.

Shape: Blade exhibits considerable symmetry in the form of a slender isosceles triangle. Edges are nearly straight with only a slight trace of convexity. Tips and edges are crisp and the tip is always on center with the stem. There is no medial ridge.

Shoulder area always rounded and on some specimens the shoulder is not clearly defined. Usually it is a graceful curve and some pieces lack distinct shoulders.

The nonparallel sides of the stem taper toward the base which is the narrowest part of the stem. The lobate base is always convex and sometimes it is nearly pointed. Basal corners are always round and never sharp. Edge grinding is frequently present.

Age and cultural affiliations: This is the second most popular point type excavated at the Kent-Hally site on Bare Island. It occurs with an overall frequency of 20 percent and its distribution was remarkably uniform in all levels. At Kent-Hally two of this type were found in intimate association with stone pots. One was inside a broken steatite bowl and the other was lying against the outside wall of the vessel (Kinsey 1959, pp. 128-129). The writer therefore suggested that this was a Late Archaic type contemporaneous with the utilization of steatite bowls, and also that the use of steatite might have been early in the lower Susquehanna since the quarries are nearby. Witthoft, to the contrary, places these points earlier in the Archaic since they are found in deeper levels on Duncan's Island. He believes the Poplar Island and Bare Island points are close contemporaries. Probably their antecedents lie in the Virginia and Carolina Piedmont and on the Savannah River in Georgia.

Distribution: The type is found in the same general area as the Bare Island point but with a lower frequency. It is particularly conspicuous on Poplar Island and Duncan's Island in the lower Susquehanna River. It also occurs along the Chesapeake and at the Accokeek Creek site.

[It has a sporadic distribution northward across Delaware and New Jersey into southern and eastern New York. (See plate 25.) W.A.R.]

References: Kinsey, 1959, p. 115, where it is referred to as "tapered or lobate-stemmed, Type C;" Witthoft, 1959, p. 83.

Remarks: At the Kent-Hally site 37.7 percent of these points are of siltstone, 24.5 percent of argillite, and 20 percent of quartz. Others are made of quartzite, rhyolite and flint. At Poplar Island and Duncan's Island the use of siltstone and argillite is also conspicuous.

ROSSVILLE POINTS (plate 26)



General description: Thick, lozenge-shaped points of medium size.

Size: Length range approximately $1\frac{1}{4}$ to $2\frac{1}{2}$ inches; majority fall between $1\frac{3}{4}$ to 2 inches. Maximum thickness varies from $\frac{1}{4}$ to $\frac{7}{16}$ of an inch in a sample of 72 from New York, with most of the specimens measuring $\frac{5}{16}$ of an inch.

Proportions: About twice as long as wide.

Shape: Roughly rhomboidal or lozenge-shaped. Some examples have weak, oblique shoulders which merge with a contracting stem terminating in a blunt point. Edges are straight or slightly excurvate.

Age and cultural affiliations: Very late Archaic, Transitional and Early Woodland periods. They occur in the lower levels of certain coastal New York shell heaps, apparently without pottery associations, and continue into the North Beach and Clearview ceramic foci. It is probable that they constitute a point type of other foci as well.

Distribution: From the Chesapeake Bay area, where it may have originated, northward through southern and southeastern New York and southern New England.

References: Skinner, 1915, p. 57; 1919, p. 70; Smith, 1950, pp. 134, 135; Holland, 1955, p. 170 (termed "Type K-Contracting Stem"); Ritchie, 1958, p. 74, figures 25, 26 (termed "lozenge-shaped points").

Remarks: Named from an early reference by Skinner to their predominance at the Rossville site on Staten Island, N. Y. (Skinner, 1915, p. 57). There seem to be no data to sustain the high antiquity accorded to this form by Skinner.

Materials are chiefly quartz and argillite in the southern part of their range, quartz and felsite in Connecticut and Massachusetts, and flint in the Hudson Valley. These points display some overlap in shape with the Poplar Island type, and a genetic relationship seems probable.

SNOOK KILL POINTS (plate 27)



General description: Very broad, large, thick, contracted stemmed points.

Size: Length range is from about 2 to 4 inches, with the majority falling between $2\frac{1}{4}$ and $3\frac{1}{2}$ inches. Thickness ranges from $\frac{1}{4}$ to $\frac{9}{16}$ of an inch; most points measure between $\frac{5}{16}$ and $\frac{7}{16}$ of an inch.

Proportions: Typically about one and one-half times as long as broad.

Shape: Blade trianguloid in outline, bi-convex or plano-convex in cross section; edges straight, slightly to moderately ex-curved, or slightly incurvate. Stem contracted or straight. Shoulders pronounced and often asymmetric. No true barbs. Base straight or slightly lobate. A very small percentage have slight to moderate basal grinding.



Age and cultural affiliations: The type overlaps with the Lehigh Broad Spear-point of Witthoft (1953, pp. 21-22), and is probably of comparable age. The author believes the Snook Kill complex will prove to be related to the even less well understood Late Archaic complex in eastern Pennsylvania to which the Lehigh point belongs. There is also enough general similarity between Snook Kill and Savannah River points to suggest a genetic relationship.

Distribution: Eastern New York, especially the Hudson Valley between Albany and Glens Falls and the lower Hoosic Valley.

References: Ritchie, 1958, pp. 91-98.

Remarks: Nearly every specimen is made of eastern New York flints, Normanskill,

Deepkill, Fort Ann; a few are of Onondaga or Oriskany flint, or of weathered argillite, probably from the Delaware Valley in New Jersey or eastern Pennsylvania, from which area the author suspects this complex entered New York.

The points exhibit broad, shallow flaking scars indicative of percussion chipping. In a fair number of cases retouching from both sides has resulted in relatively thin, sharp, straight or slightly sinuous edges.

Snook Kill points were probably employed on darts and spears. Some with markedly convex edges (plate 27, figures 2 and 3), and especially the variant with asymmetric edges and almost lozenge-shaped base, were doubtless knives.

SNYDERS POINTS (plate 28)

The following description is based upon Scully (1951) and Bell (1958).

General description: A large, broad, ovate point with deep corner notches.

Size: The length range is from about 2 to 6 inches, the majority falling between $2\frac{1}{2}$ and 3 inches.

Proportions: About four-fifths as wide as it is long.

Shape: Blade broad and ovate in outline, relatively thin and nearly flat in cross section, edges excurvate. Stem short, deeply and usually broadly corner-notched, and basally expanding. Base markedly convex.

Age and cultural affiliations: It is a characteristic form of the Hopewellian culture of Middle Woodland age (approximately 500 B.C. to A.D. 500).

Distribution: Central and northern Illinois, southwestern Michigan, eastern Missouri, northeastern Oklahoma, the central Mississippi Valley, the middle and upper Ohio Valley, and elsewhere, including western New York.

References: Scully, 1951, p. 12; Bell, 1958, pp. 88-89.

Remarks: Of rare occurrence in New York, where its distribution coincides with that of Hopewellian burial mounds. Most New York examples are made of Harrison County, Indiana or Flint Ridge, Ohio materials.

STEUBENVILLE LANCEOLATE POINTS (plate 29)



General description: Rather broad, lanceolate points, of medium to large size, with slightly concave bases.

Size: Length range from about 1 to $3\frac{3}{16}$ inches; the majority measuring between 2 and 3 inches. Thickness (of the small sample from New York State) $\frac{5}{16}$ to $\frac{3}{8}$ of an inch.

Proportions: These points are two to two and one-half times as long as wide.

Shape: Lanceolate, with excurve or slightly recurvate edges. Biconvex in cross section. Base usually mildly to moderately constricted and slightly concave. No smoothing, but occasional thinning present in the New York sample.

Age and cultural affiliations: Problematical in the New York area. Found in the Panhandle Archaic of West Virginia in association with the Steubenville Stemmed type.

In eastern and southern New York State, where a similar point association occurs, early pottery styles are evidently also present.

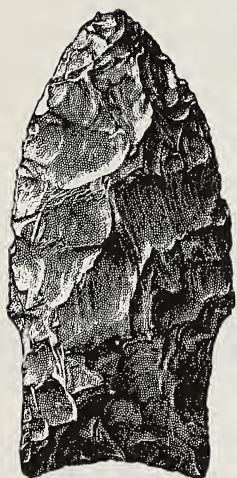
See fuller data under Steubenville Stemmed type, pp. 51, 52.

Distribution: The West Virginia Panhandle area and elsewhere in the upper Ohio Valley; central New York, especially in the upper Susquehanna Valley region; eastern New York, particularly in the Hudson Valley south from Greene and Columbia Counties; Staten Island, Long Island, and the upper Delaware Valley in New Jersey, Pennsylvania and New York.

References: The Steubenville Lanceolate and Stemmed points were named, but not defined or formally described, by Mayer-Oakes, 1955, pp. 130-142; 1955a, pp. 8, 17-20; Ritchie, 1958, p. 99.

Remarks: These points are generally made of regional flints. In the lower Hudson and upper Delaware River regions, however, a purple or gray-weathering black argillite predominates.

STEUBENVILLE STEMMED POINTS (plate 30)



General description: Broad, heavy points of medium to large size, with wide stems and very weak shoulders.

Size: In the sample of about 50 New York points studied, the length ranged from $1\frac{3}{4}$ to $3\frac{1}{2}$ inches, with the majority measuring between 2 and $2\frac{1}{2}$ inches. The thickness varied from $\frac{1}{4}$ to $\frac{7}{16}$ of an inch, most examples falling into the narrow range between $\frac{5}{16}$ and $\frac{3}{8}$ of an inch.

Proportions: From about one and one-fourth to two and one-half times as long as wide, with most of the points closer to the former proportions, giving them a short, wide, "stubby" appearance.

Shape: Blade outline ovate, lanceolate or trianguloid in descending order of frequency; mildly biconvex in cross section; edges excurvate. Stem wide, with very small, right angular or sloping (obtuse angular) shoulders. In many cases the shoulders are so weakly developed as to be almost nonexistent, and such intergrades link the stemmed and lanceolate forms. Base concave or less often straight. Very slight smoothing of the basal and/or stem edges, apparently more from use than design, occurs on a small proportion of the specimens. In a few of the specimens the base has been thinned by the removal from one side of the stem of one or more shallow vertical channel flakes.

Age and cultural affiliations: Currently unknown in the New York area. Part of the Panhandle Archaic of West Virginia. Mayer-Oakes regards this and the culturally related Steubenville Lanceolate form as very early Archaic in the upper Ohio Valley. He makes the assumption that "They were derived from the late Paleo-Indian 'Scottsbluff' and 'Starved Rock Lanceolate' types, which came into the area from the west at about the time of the post-glacial climatic maximum." (Mayer-Oakes, 1955a, p. 20.) Dragoo, on the other hand, would place the Steubenville types in the Late Archaic complexes of the upper Ohio Valley (Dragoo, 1959, pp. 202-206, 210, 213).

In eastern and southern New York State there is some evidence that these types have ceramic associations. On the Ford site (Ct. 16-2),

Columbia County, they have been found on the same level with net-impressed, grit-tempered, or shell-tempered and leached pottery.

"At Pelham Boulder [Har. 4-4, Bronx County], the Steubenvilles were in or near sherd clusters in the bottom third of the midden; collectively the types are Vinette 1, Modified Vinette 1, Fabric Impressed, Net Impressed, Exterior Cord marked (like Vinette 1 and Modified Vinette 1 except that there are no interior cordmarks) and Abbott Zoned Dentate." (Julius Lopez, letter of January 3, 1960; cf. Lopez, 1956, p. 15.)

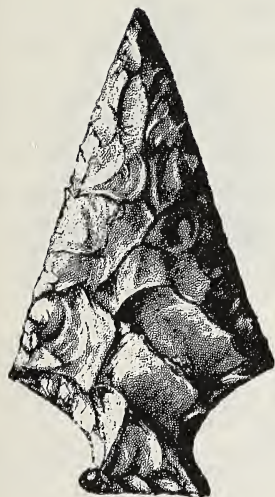
Distribution: The upper Ohio Valley, especially the West Virginia Panhandle area; central New York, particularly the Susquehanna Valley around Colliersville, Otsego County, and sporadically down river at least to Susquehanna, Pennsylvania; eastern New York, chiefly the Hudson Valley from Greene and Columbia Counties southward to the mouth of the river; Staten Island; western Long Island; the upper Delaware Valley in New Jersey, Pennsylvania and New York.

No doubt, as this point type becomes more generally recognized, the range will be considerably extended, at least to include some of the intervening areas.

References: The Steubenville Stemmed and Lanceolate types were named, but not defined or formally described, by Mayer-Oakes, 1955, pp. 130-142; 1955a, pp. 8, 17-20; Ritchie, 1958, p. 99.

Remarks: In most areas, local materials seem to predominate in the composition of these points. In central and eastern New York, however, a small percentage is comprised of purple- or gray-weathering argillite, presumably derived from the Delaware Valley of New Jersey. The incidence of argillite as a material rises sharply in the lower Hudson and Delaware Valleys.

SUSQUEHANNA BROAD POINTS (plate 31)



This point type has been described by John Witthoft of the Pennsylvania State Museum as the Susquehanna Broad Spearpoint. The following discussion is taken very largely from his work, cited below, as it applies with equal validity to the New York material in my sample of several hundred points.

General description: "Broad, boldly flaked spearpoints of roughly semi-lozenge to rough corner-notched shape, with certain characteristic contour details."

Size: "Most specimens are between an inch and a half and four inches long; rare examples are as short as an inch and as long as eight inches."

The thickness of a representative sample of New York points varied between $\frac{3}{16}$ and $\frac{3}{8}$ of an inch.

Proportions: "Generally half as broad as long, or less. Rarely quite narrow."

Shape: "Blade: Triangular, usually with some portion of the edges convex, especially near tip. Edge often somewhat concave near base. Frequently not symmetrical. In cross section, the faces of the blade are evenly rounded rather than keeled or flat. Retouching of the edge to final contour was usually from one face of the blade.

"Ears [Shoulders]: Not barbed, but jutting in a characteristic fashion. The ears are usually angular, forming an obtuse angle, and are sometimes somewhat rounded. In either case, they are always thin and sharp, carefully retouched to thin, straight edges.

"Tang [Stem]: Always constricted and almost always with a concave base; base is rarely straight or extremely concave. Base of the tang narrower than the ears, with tang corners generally acute and prominent. All edges of the tang are always ground smooth, including the basal corners of the tang."

Age and cultural affiliations: Transitional period linking Late Archaic and Early Woodland periods. Probably between approximately 1200 and 700 B.C. The culture complex (or complexes) to which

these points belong is poorly known, and with one exception, comes from surface sites. They form part of a widely spread steatite or soapstone pot-using culture which, in the Susquehanna Valley, has a very limited associated complex mainly comprising distinctive forms of chipped drills and scrapers, netsinkers, and crude ornaments of steatite.

Distribution: The Susquehanna Valley in Pennsylvania and New York and its principal tributaries; the Delaware drainage system north of the Water Gap; the Hudson and Mohawk Valleys; the Finger Lakes region and the Seneca River and its affluent sources, including Oneida Lake. The center of distribution seems to have been the Susquehanna Valley in Pennsylvania.

References: Witthoft, 1953, pp. 7-16.

Remarks: In Pennsylvania, nearly all points of this type are said to be made of purplish rhyolite derived from outcrops of this metamorphosed volcanic rock in Franklin and Adams Counties, near Gettysburg, Pennsylvania. This material also composes a large number of the New York specimens and, together with the frequently associated steatite, proves the intrusive nature of these artifacts, and almost certainly of the complex to which they pertain. However, a much larger proportion of the New York specimens, contrary to Witthoft's statement (op. cit. pp. 8, 12) are of the local flints, for the most part Onondaga, and constitute local copies of the introduced points.

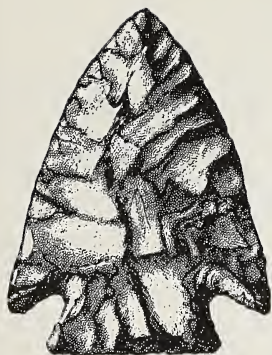
Susquehanna Broad points of rhyolite and flint, associated with steatite pot fragments, were excavated from the upper level of the Frontenac Island site, Cayuga County, N.Y., above deeper deposits of Archaic age (Ritchie, 1945).

Witthoft has classified these points as "spearpoints" but has not defined the term. The author has distinguished between spearpoints and dartpoints earlier in this study (see pages 5-6).

He suspects that the shorter examples were dartpoints. Some of the very thin and fragile specimens may well have served as knives.

The writer has attempted to show the existence, chiefly in eastern and southern New York, of intergrades connecting the Susquehanna Broad point with the Orient Fishtail point (Ritchie, 1959, pp. 90-91, 169).

VOSBURG POINTS (plate 32)



General description: Medium sized, broad, relatively thin points, with small to medium corner notches on a prevailing short stem which is basally ground smooth.

Size: The length range is from about one to $2\frac{3}{4}$ inches, the majority falling between $1\frac{1}{2}$ and 2 inches, with a maximum thickness of $\frac{3}{16}$ to $\frac{1}{4}$ of an inch. Longer points, probably spearheads, do occur, the largest seen measuring $4\frac{1}{2}$ inches long, $1\frac{1}{2}$ inches wide, and $\frac{3}{8}$ of an inch thick (plate 32, figure 11).

Proportions: Length averages about one-quarter greater than breadth in most specimens. The larger points are two to two and one-half times as long as wide.

Shape: The blade is trianguloid in outline, slightly biconvex or nearly flat in cross section; the edges are straight, mildly excurvate, or rarely incurvate. A slight degree of serration is not uncommon. The stem is corner-notched, usually with small notches forming rather weak barbs, expanded, and usually very short. The base is straight or slightly concave, and nearly always ground smooth.

Age and cultural affiliations: An important point form of the Vosburg complex, Laurentian tradition, occurring in varying proportions on nearly all sites of this manifestation. Examples were present in Level 4, or near the base of the stratified Lotus Point site in the Hudson Valley, hence they seem to have appeared rather early in the Archaic horizon of this area.

Distribution: Primarily an eastern New York form, especially in the Hudson, Mohawk and Hoosic Valleys. Of sporadic occurrence in peripheral regions. A few examples were excavated at the Robinson site of the Brewerton complex, Laurentian tradition.

References: Ritchie, 1940, p. 29; 1944, pp. 257-259; 1958, pp. 19, 32, 59, 69, 80. In the last reference the type is referred to as "Vosburg Corner-Notched."

Remarks: Generally made of eastern New York Normanskill and Deepkill flints, apparently by pressure flaking techniques.

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PLATE 1—ADENA POINTS

1-3, 5, 6, Van Orden site, Greene County, N. Y.; 4, 8, 9, Onondaga County, N. Y.; 7, Cattaraugus County, N. Y.

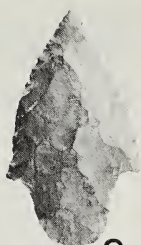
1-3, 5, 6, Carl S. Sundler collection; others N. Y. S. Mus. collection.

Material: 1, 2, Normanskill flint; 3, 5, 6, Fort Ann flint; 4, 8, Onondaga flint; 7, Harrison County, Ind. flint; 9, exotic flint.

NEW YORK PROJECTILE POINTS



1



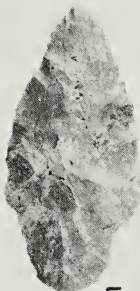
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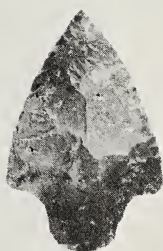
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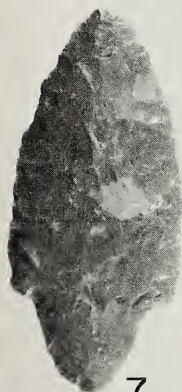
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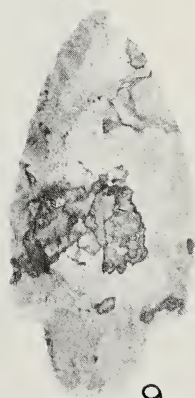
6



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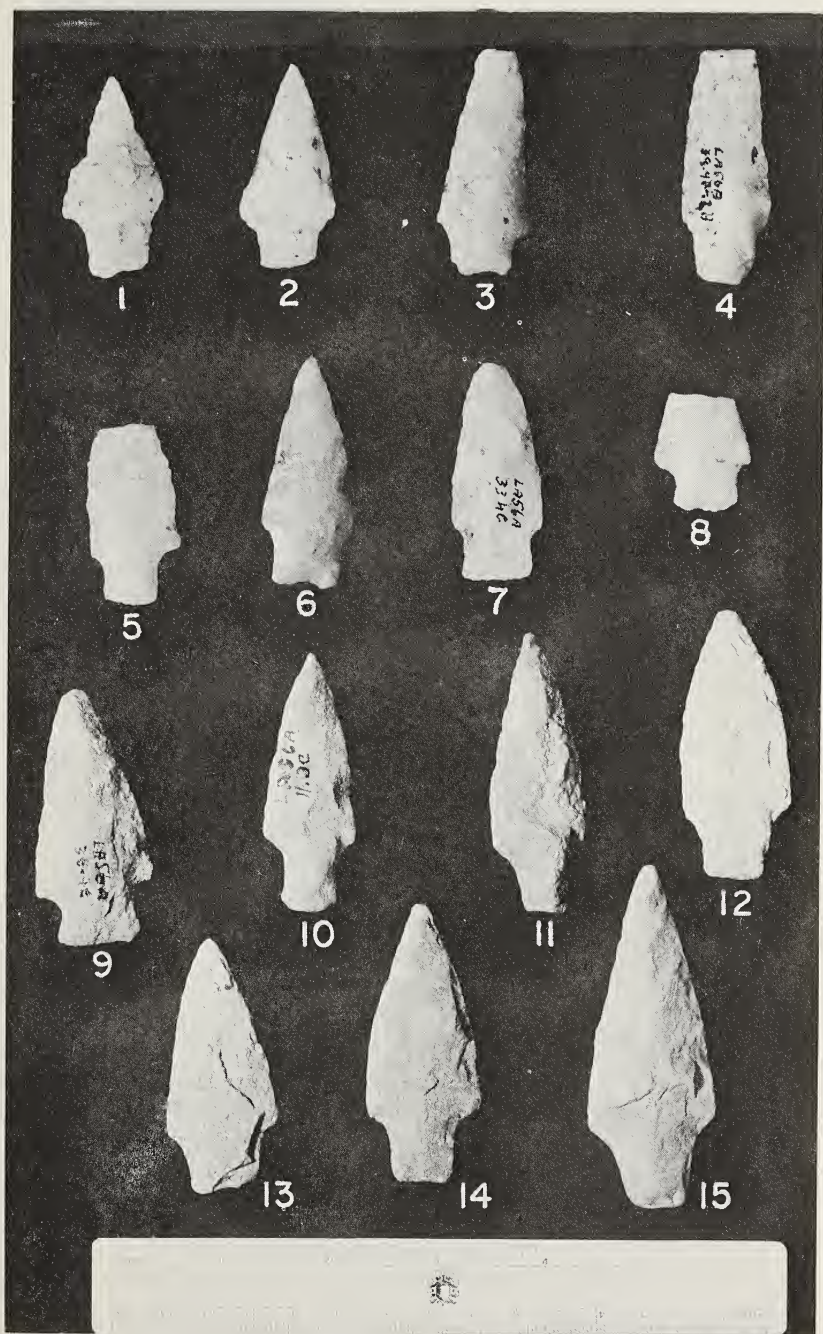
PLATE 2—BARE ISLAND POINTS

Kent-Hally site, Bare Island, Lancaster County, Pa.

Collection of Pennsylvania Historical and Museum Commission by whose courtesy they are reproduced.

Material: 1-8, quartz; 9, quartzite; 10-12, 14, 15, siltstone; 13, rhyolite.

NEW YORK PROJECTILE POINTS



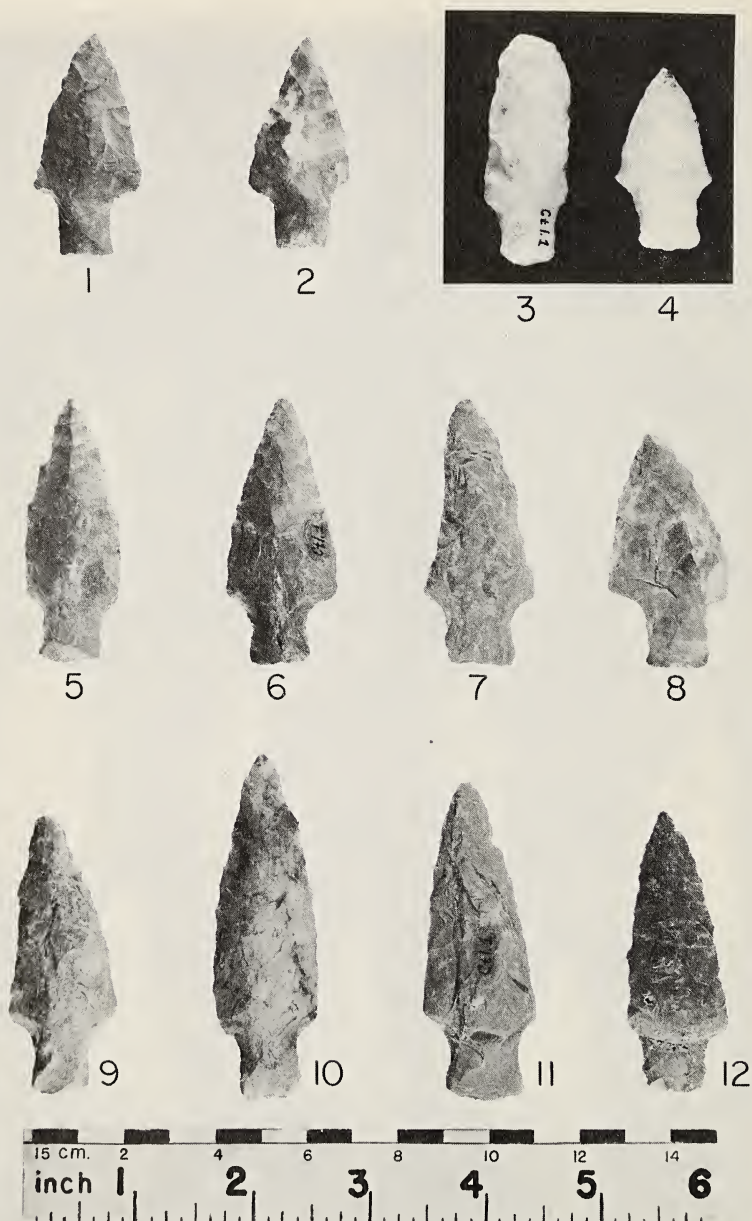


PLATE 3—BARE ISLAND POINTS

1-9, 11, 12, Van Orden site, Greene County, N. Y.; 10, Coh. 9 site, Rensselaer County, N. Y.

Collection Carl S. Sundler.

Material: 1, 2, 5, 6, 12, Deepkill flint; 3, 4, quartz; others Normanskill flint.

PLATE 4—BREWERTON CORNER-NOTCHED POINTS

1, 4, 5, 9, Oberlander No. 1 site, Brewerton, Oswego County, N. Y.; 2, 6, 10, 12, Robinson site, Brewerton, Onondaga County, N. Y.; 3, 7, 8, 11, Onondaga County, N. Y.

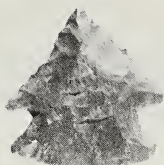
1, 2, 4-6, 9, 10, 12, collection of Rochester Museum of Arts and Sciences; others collection of N. Y. State Museum.

Material: All Onondaga flint.

NEW YORK PROJECTILE POINTS



1



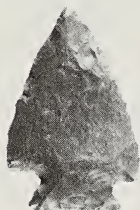
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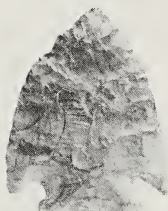
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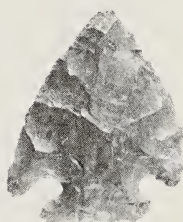
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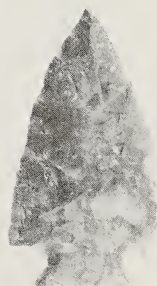
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12

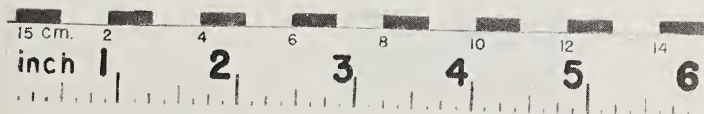


PLATE 5—BREWERTON EARED-NOTCHED POINTS

1-3, 7, 8, Onondaga County, N. Y.; 4, Coh. 9 site, Rensselaer County, N. Y.; 5, 6, Robinson site, Brewerton, Onondaga County, N. Y.; 9, Van Orden site, Greene County, N. Y.

4, 9, Carl S. Sundler collection; 5, 6, collection of Rochester Museum of Arts and Sciences; others N. Y. State Museum collection.

Material: 1-3, 5-8, Onondaga flint; 4, 9, Normanskill flint.

NEW YORK PROJECTILE POINTS

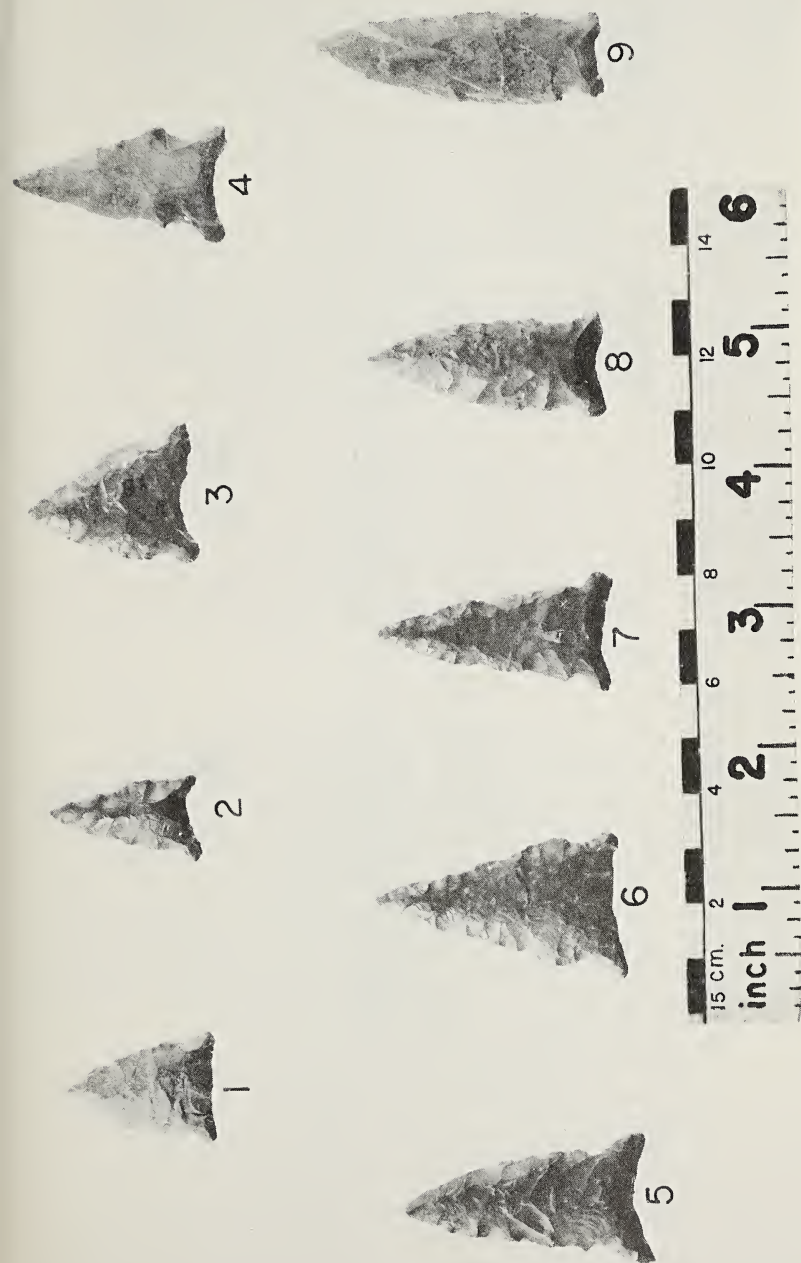


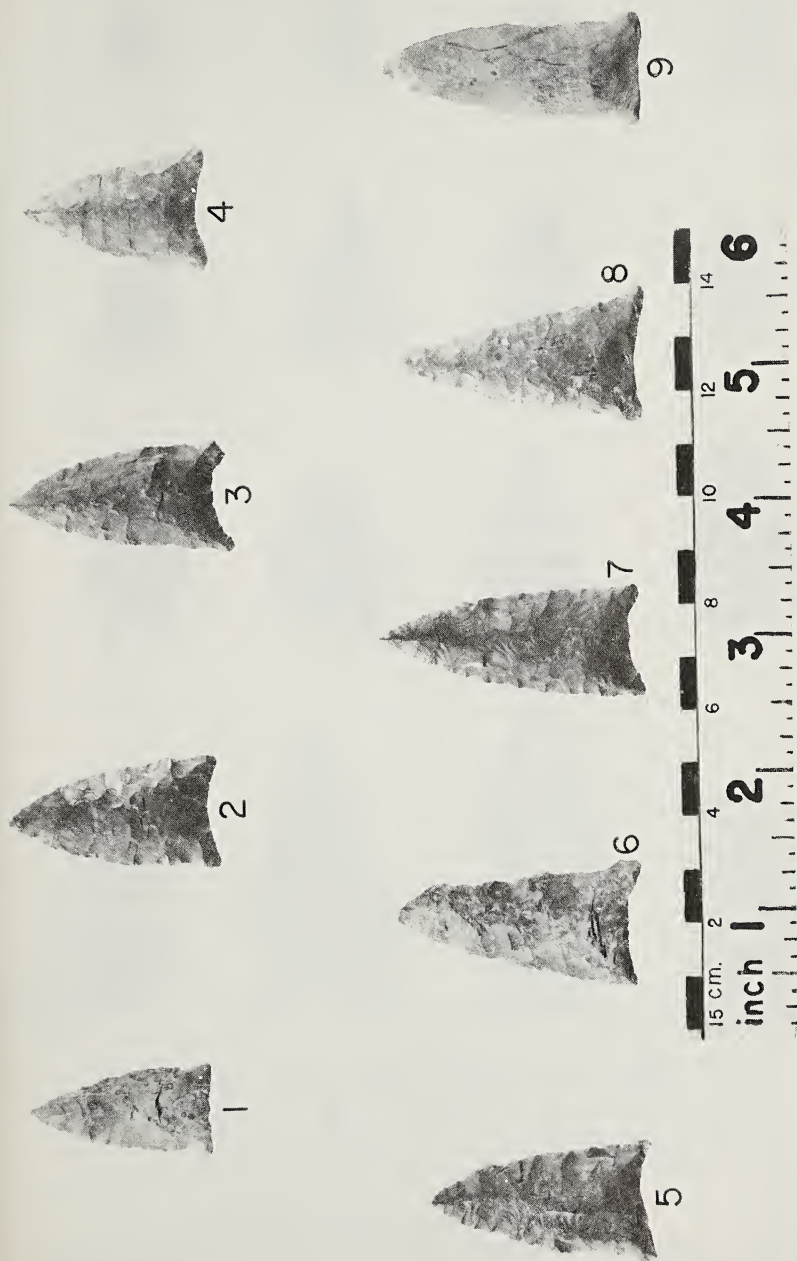
PLATE 6—BREWERTON EARED-TRIANGLE POINTS

1, 9, Coh. 9 site, Rensselaer County, N. Y.; 2-5, 7, Robinson site, Brewerton, Onondaga County, N. Y.; 6, Barren Island site, Albany County, N. Y.; 8, Onondaga County, N. Y.

1, 9, Carl S. Sundler collection; 2-5, 7, collection of Rochester Museum of Arts and Sciences; 6, R. Arthur Johnson collection; 8, N. Y. State Museum collection.

Material: 1, Deepkill flint; 2-5, 7, 8, Onondaga flint; 6, 9, Normanskill flint.

NEW YORK PROJECTILE POINTS



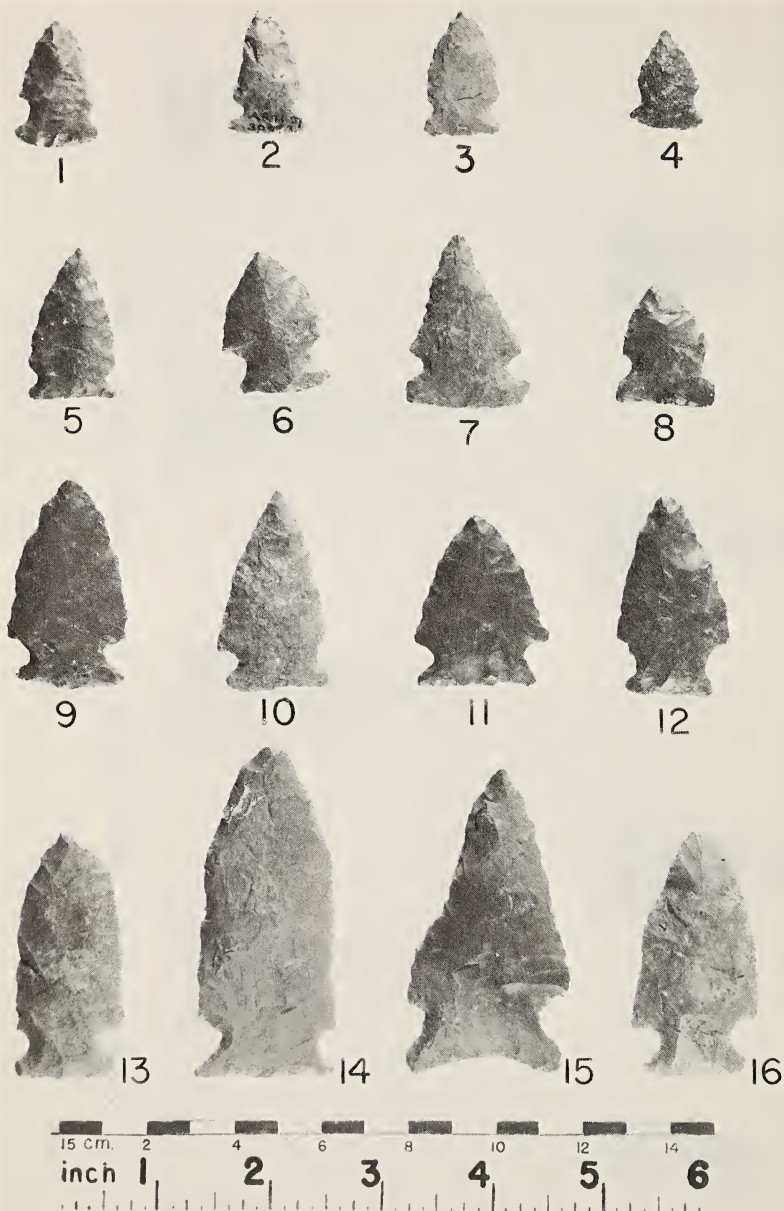


PLATE 7—BREWERTON SIDE-NOTCHED POINTS

1-5, 7-8, 13-16, Robinson site, Brewerton, Onondaga County, N. Y.; others Oberlander No. 1 site, Brewerton, Oswego County, N. Y.

All in collection of Rochester Museum of Arts and Sciences.

Material: All Onondaga flint.

PLATE 8—CLOVIS POINTS

1, Cte. 1-2 site, Deer River, Lewis County, N. Y.; 2, Onondaga County, N. Y.; 3, Kingston site No. 2, Ulster County, N. Y.; 4, 7, 8, Coxsackie, Greene County, N. Y.; 5, Livingston County, N. Y.; 6, Lot 12, Van Buren, Onondaga County, N. Y.

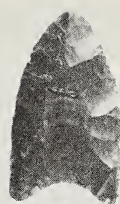
All in collection of N. Y. State Museum.

Material: 1, Little Falls dolomite flint; 2, 3, 5, 8, jasper; 4, Deepkill flint; 6, 7, Onondaga flint.

NEW YORK PROJECTILE POINTS



1



2



3



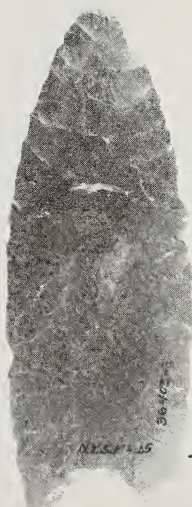
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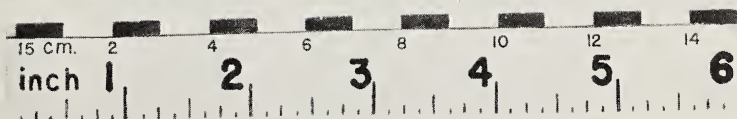




PLATE 9—FULTON TURKEY TAIL POINTS

1, Seneca River, Onondaga County, N. Y.; 2, 3, Brewerton, Onondaga County, N. Y.
All in collection of N. Y. State Museum.
Material: All of Harrison County, Ind. flint.

NEW YORK PROJECTILE POINTS

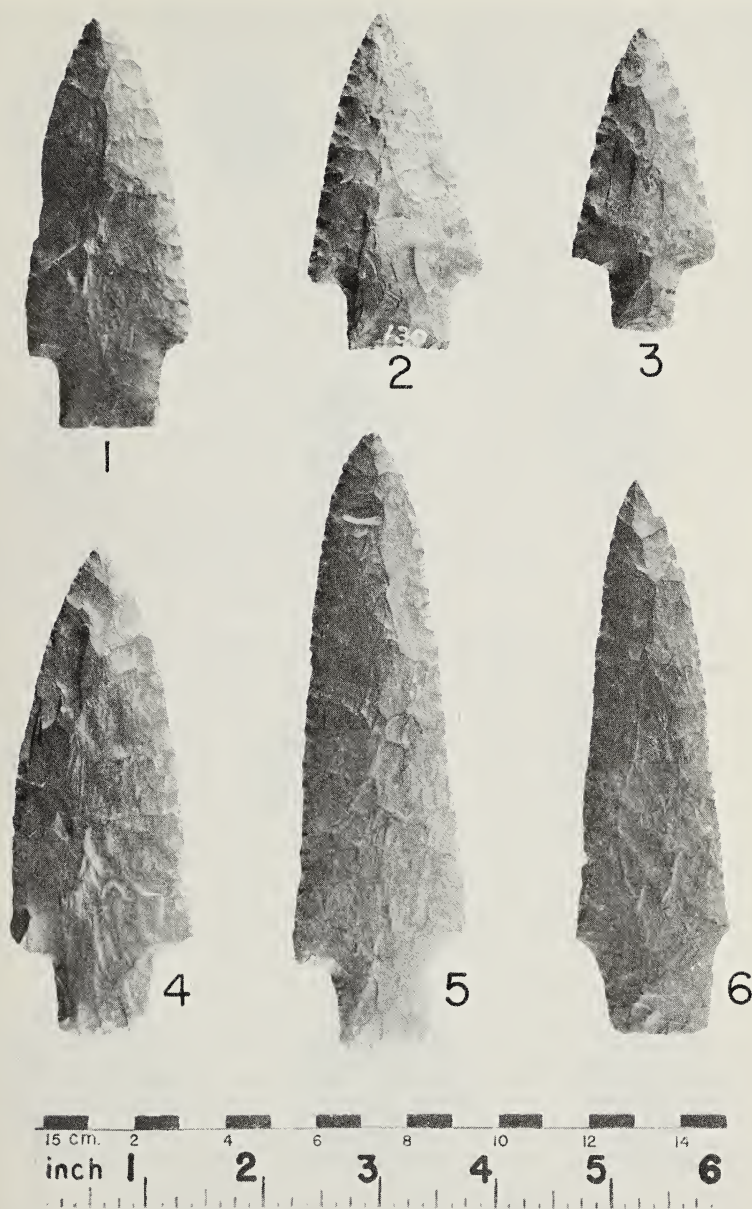


PLATE 10—GENESEE POINTS

1, 3, 6, Lysander, Onondaga County, N. Y.; 2, Gucker site, Charlotte, Monroe County, N. Y.; 4, Wyoming County, N. Y.; 5, Onondaga County, N. Y. (?).

All in collection of N. Y. State Museum.

Material: All of Onondaga flint.

PLATE 11—JACK'S REEF CORNER-NOTCHED POINTS

1-3, 7, Van Buren, Onondaga County, N. Y.; 4, Coh. 9 site, Rensselaer County, N. Y.; 5, 8, 10, 11, Onondaga County, N. Y.; 6, Van Orden site, Greene County, N. Y.; 9, Afton, Chenango County, N. Y.; 12, Lysander, Onondaga County, N. Y.; 13, Onondaga County, N. Y. (?).

4, 6, Carl S. Sundler collection; others N. Y. State Museum collection.

Material: 1, 2, 13, jasper; 5, Flint Ridge, Ohio chalcedony; others Onondaga flint.

NEW YORK PROJECTILE POINTS



1



2



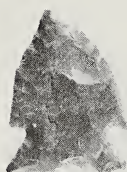
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4



5



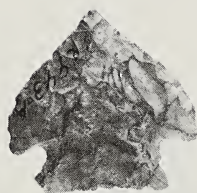
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13



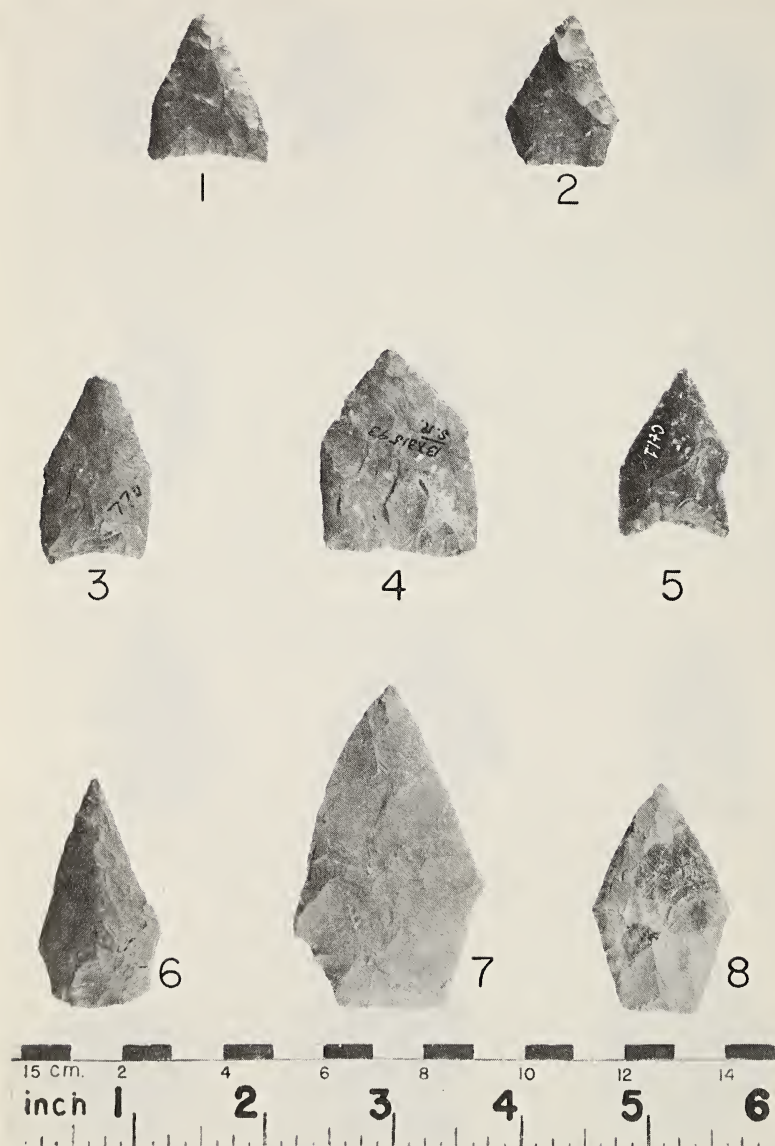


PLATE 12—JACK'S REEF PENTAGONAL POINTS

1, Wickham site, Brewerton, Oswego County, N. Y.; 2, 4, 6, 7, Onondaga County, N. Y.; 3, Clifton Park, Saratoga County, N. Y.; 5, 8, Van Orden site, Greene County, N. Y. 5, 8, collection of Carl S. Sandler; others N. Y. State Museum collection. Material: 7, 8, Deepkill flint; others of Onondaga flint.

PLATE 13—LAMOKA POINTS

1-12, 14-17, 20-24, Frontenac Island site, Cayuga County, N. Y.; others Lamoka Lake site, Schuyler County, N. Y.

All N. Y. State Museum collection.

Material: All of Onondaga flint, except 9, 13, 17, 23, 27, which are of argillaceous quartzite.

NEW YORK PROJECTILE POINTS

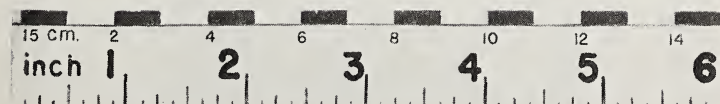
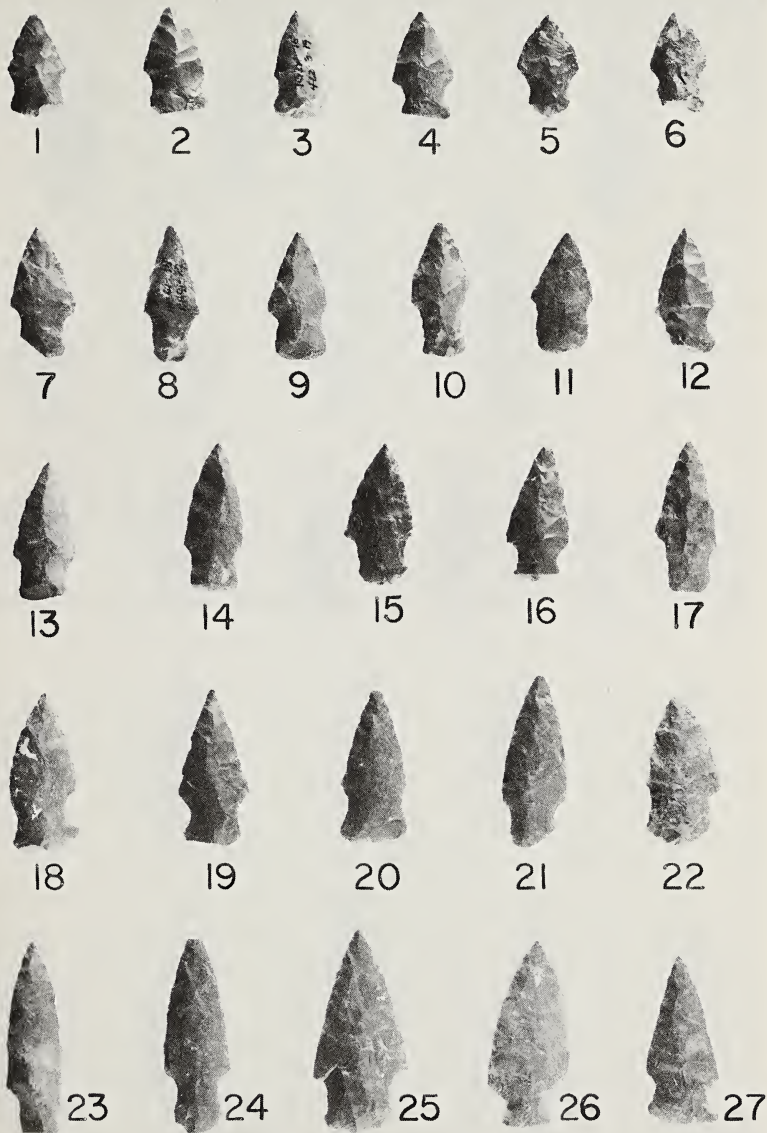


PLATE 14—LAMOKA AND "DUSTIN" POINTS

1-9, "Dustin" points, surface sites in Michigan; others Lamoka Lake site, Schuyler County, N. Y.

1-9, Museum of Anthropology, University of Michigan collection; others collection of Rochester Museum of Arts and Sciences.

Material: 1-9, various flints and jaspers; others Onondaga flint, except 18, which is of argillaceous quartzite.

NEW YORK PROJECTILE POINTS

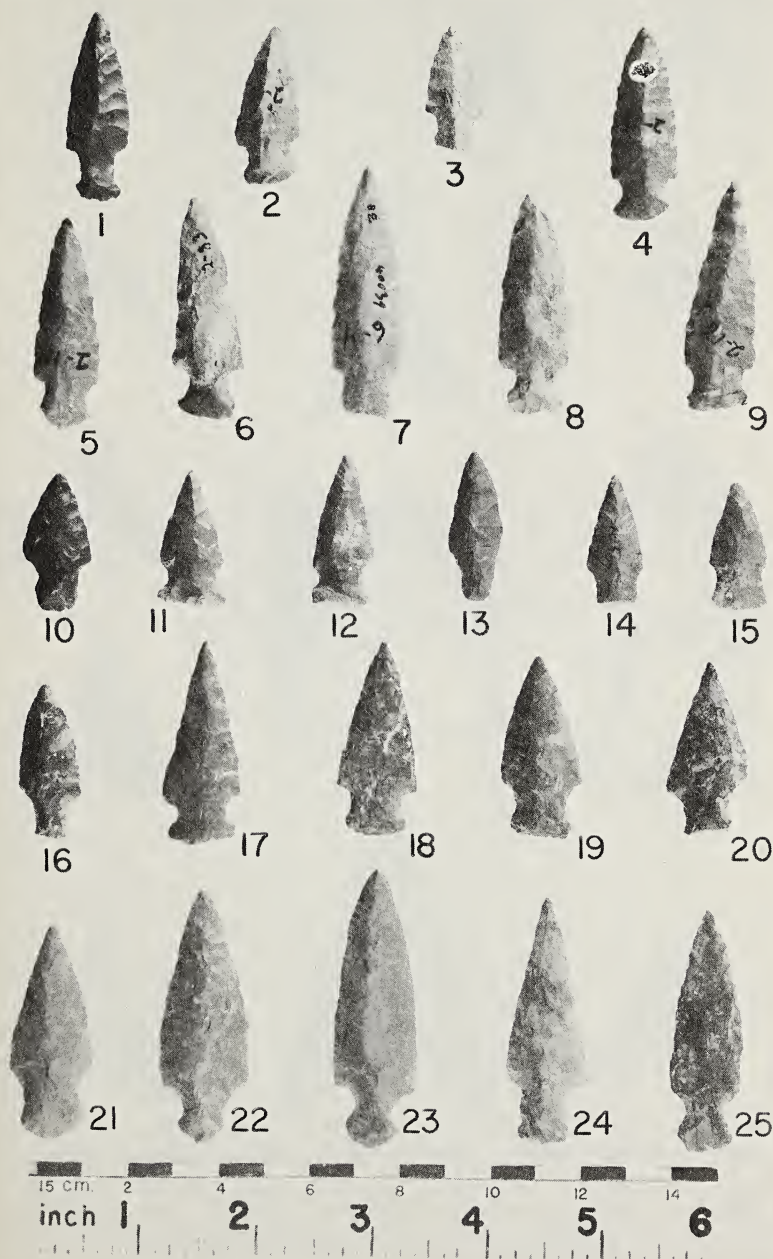


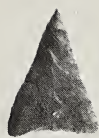
PLATE 15—LEVANNA POINTS

1, 3, 6-9, Wickham site, Brewerton, Oswego County, N. Y.; 2, 4, Sackett site, Canandaigua, Ontario County, N. Y.; 5, Chemung County, N. Y.; 10, South Cruger Island site, Dutchess County, N. Y.; 11, Patchogue, Suffolk County, N. Y.; 12, Schaghticoke, Rensselaer County, N. Y.; 13, Van Orden site, Greene County, N. Y.; 14, Clifton Park, Saratoga County, N. Y.; 15, Bates site, Chenango County, N. Y.

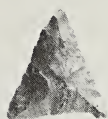
All collection of N. Y. State Museum, except 13, collection of Carl S. Sundler.

Material: All Onondaga flint, except 11, 12, which are of quartz.

NEW YORK PROJECTILE POINTS



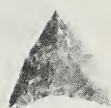
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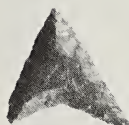
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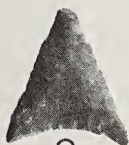
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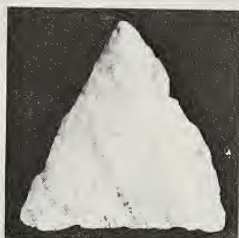
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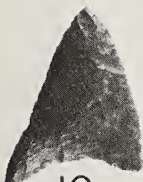
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11



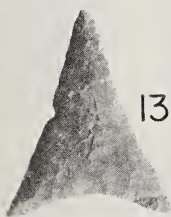
9



10



12



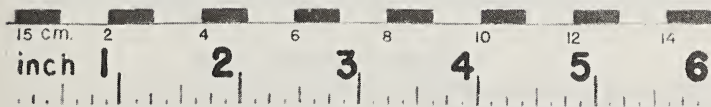
13



14



15



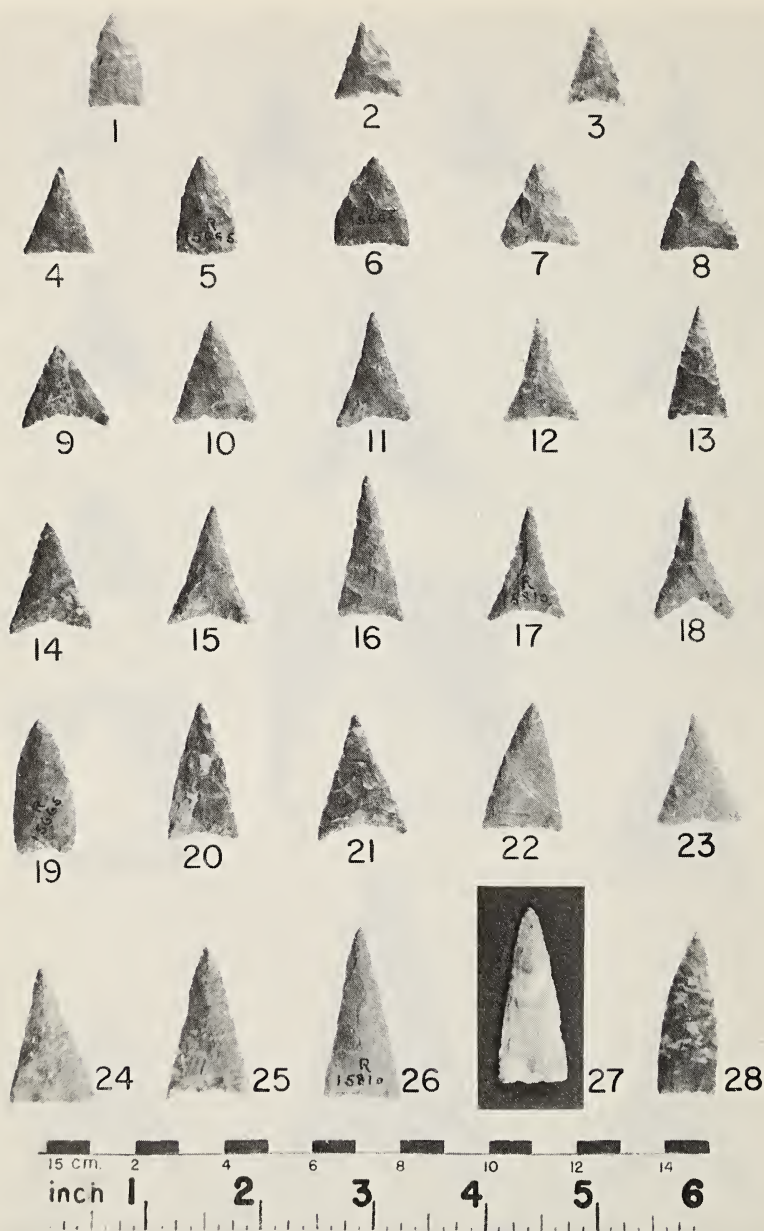


PLATE 16—MADISON POINTS

George Reed site, Richmond Mills, Ontario County, N. Y.
N. Y. State Museum collection.

Material: All Onondaga flint, except 27, which is of Flint Ridge, Ohio chalcedony, a very unusual material for Madison points.

NEW YORK PROJECTILE POINTS

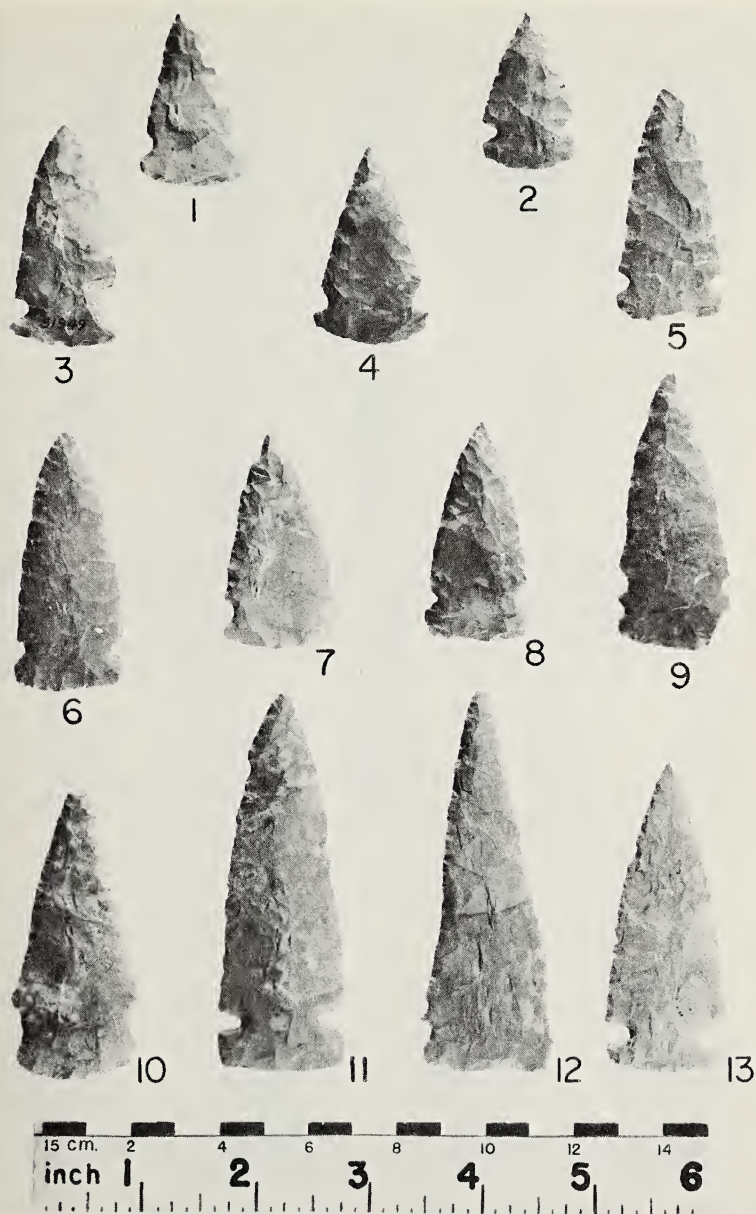


PLATE 17—MEADOWWOOD POINTS

1, 2, 4, 5, 7-9, 11, Onondaga County, N. Y.; 3, 6, Elbridge, Onondaga County, N. Y.; 10, 13, Morrow site, Honeoye, Ontario County, N. Y.; 12, Lysander, Onondaga County, N. Y.

Collection of N. Y. State Museum.

Material: All Onondaga flint, chiefly western N. Y. variety.

PLATE 18—NORMANSKILL POINTS

1, 2, 6, 9, 18, Harris site, Saratoga County, N. Y.; 3, 15, Vosburg site, Albany County, N. Y.; 4, 8, 10, 14, 16, 17, River site, Saratoga County, N. Y.; 5, 13, 19, South Cruger Island site, Dutchess County, N. Y.; 7, 12, Coh. 9 site, Rensselaer County, N. Y.; 11, West Albany, Albany County, N. Y.

1, 2, 5, 6, 9, 13, 18, 19, collection of N. Y. State Museum; 3, 15, collection of James H. Zell; 4, 7, 8, 10, 14, 16, 17, collection of William Kirby; 11, 12, collection of Carl S. Sundler.

Material: All eastern N. Y. flints—Deepkill, Normanskill and Fort Ann.

NEW YORK PROJECTILE POINTS

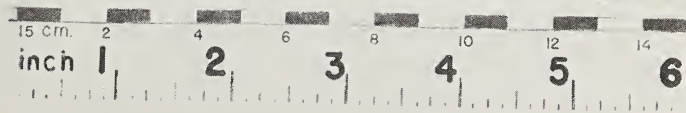
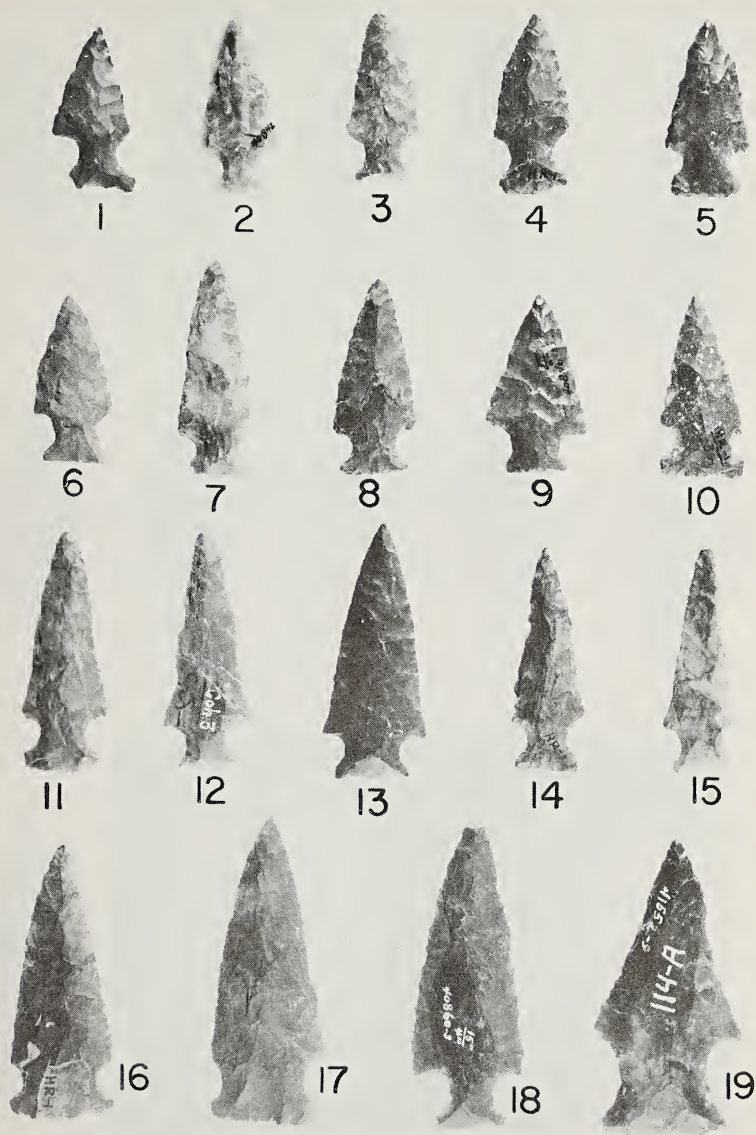


PLATE 19—ORIENT FISHTAIL POINTS

1-4, 6, 7, 9, Van Orden site, Greene County, N. Y.; 5, 8, 13-15, Jamesport site, Suffolk County, N. Y.; 10, Lysander, Onondaga County, N. Y.; 11, 12, Stony Brook site, Suffolk County, N. Y.

1-4, 6, 7, 9, Carl S. Sundler collection; others N. Y. State Museum collection.

Material: 1, Normanskill flint; 2-7, 9, Deepkill flint; 8, 11-13, quartzite; 14, 15, quartz.

NEW YORK PROJECTILE POINTS

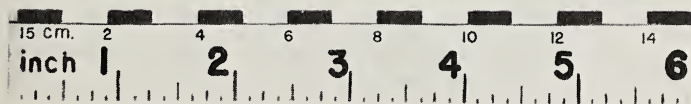
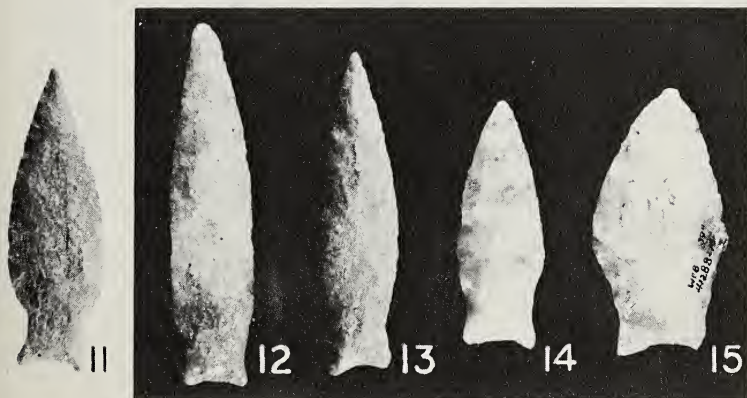
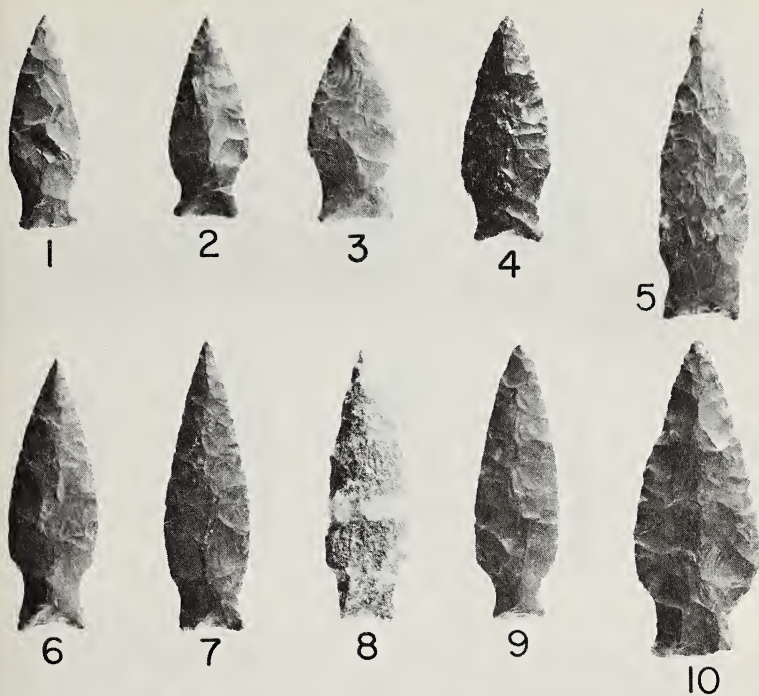




PLATE 20—OTTER CREEK POINTS

KI site, Rutland County, Vt.

2, 4, 6-9, 11, 13-15, collection of Thomas E. Daniels; others collection of Kathleen Rowlands.

Material: 1, 12, 13, metamorphosed siltstone; 2, 6, 9-11, 14, 15, quartzite; 3, 7, 8, Normanskill (?) flint; 4, 5, banded gray flint.

PLATE 21—OTTER CREEK POINTS

1, 4, 5, Van Orden site, Greene County, N. Y.; 2, 6, 7, Malta, Saratoga County, N. Y.;
3, South Cruger Island site, Dutchess County, N. Y.

1, 4, 5, collection of Carl S. Sundler; others N. Y. State Museum collection.

Material: All Normanskill flint.

NEW YORK PROJECTILE POINTS

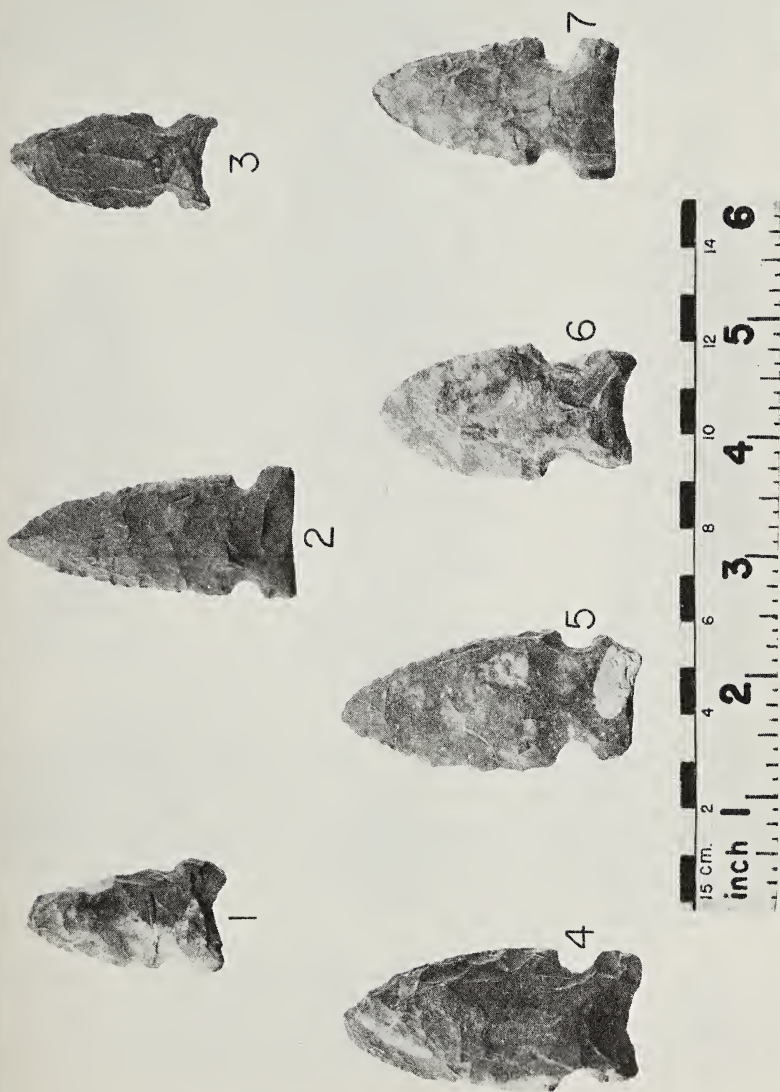




PLATE 22—OTTER CREEK POINTS

- 1, Stillwater, Saratoga County, N. Y.; 2, Bemis Heights, Saratoga County, N. Y.;
3, Fish Creek, Saratoga County, N. Y.
N. Y. State Museum collection.
Material: All Normanskill flint.

NEW YORK PROJECTILE POINTS

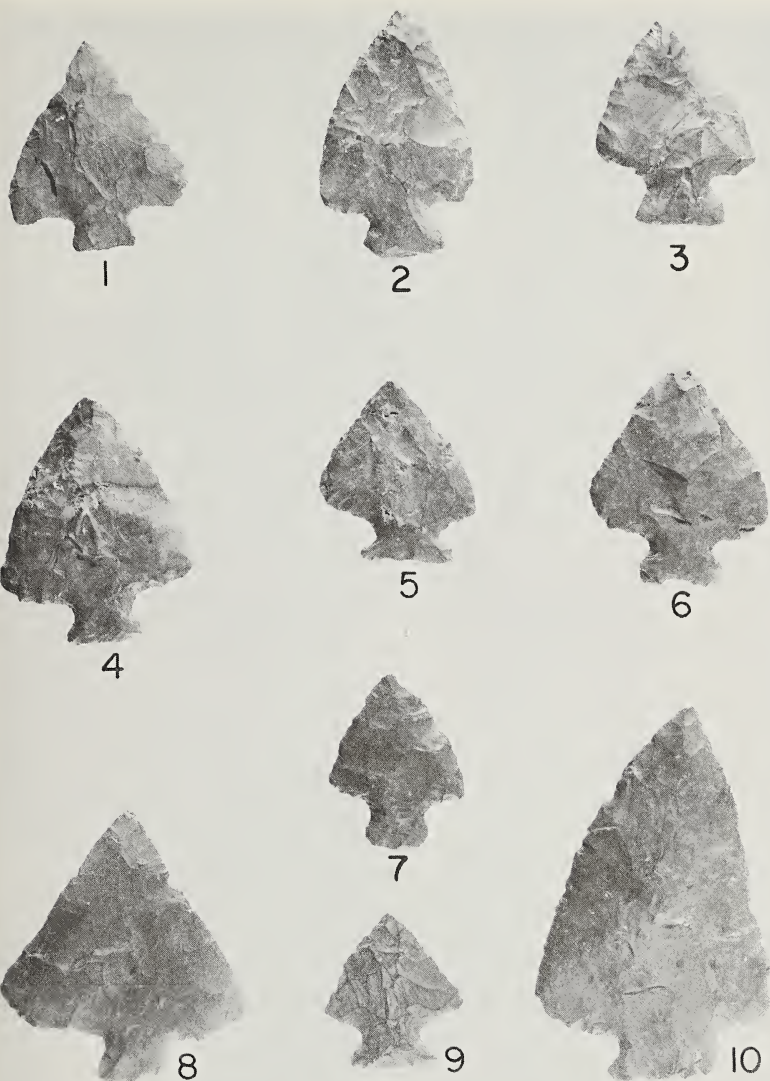


PLATE 23—PERKIOMEN BROAD POINTS

Found along Seneca River, Onondaga County, N. Y.

N. Y. State Museum collection.

Material: All Onondaga flint

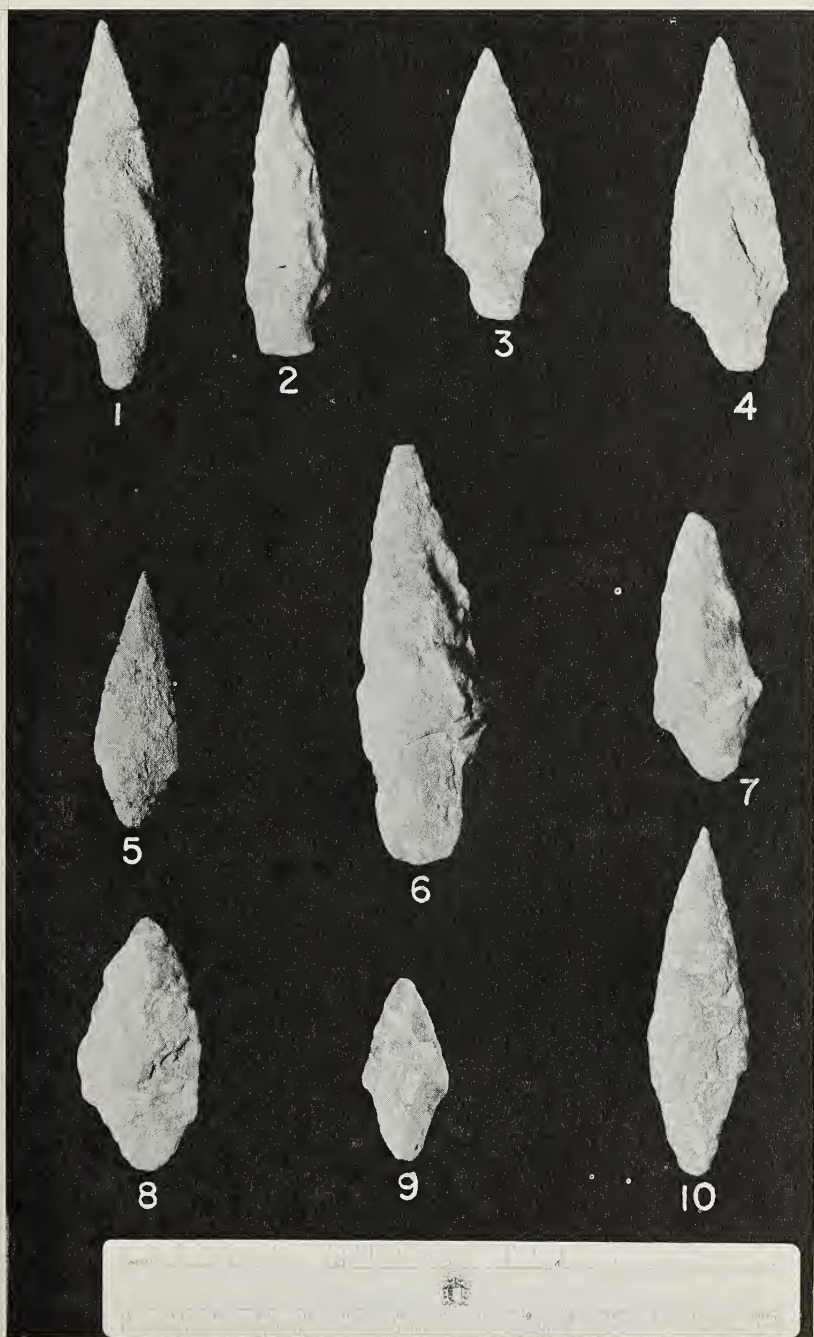
PLATE 24—POPLAR ISLAND POINTS

Kent-Hally site, Bare Island, Lancaster County, Pa.

Collection of Pennsylvania Historical and Museum Commission by whose courtesy they are reproduced.

Material: Argillite and siltstone.

NEW YORK PROJECTILE POINTS



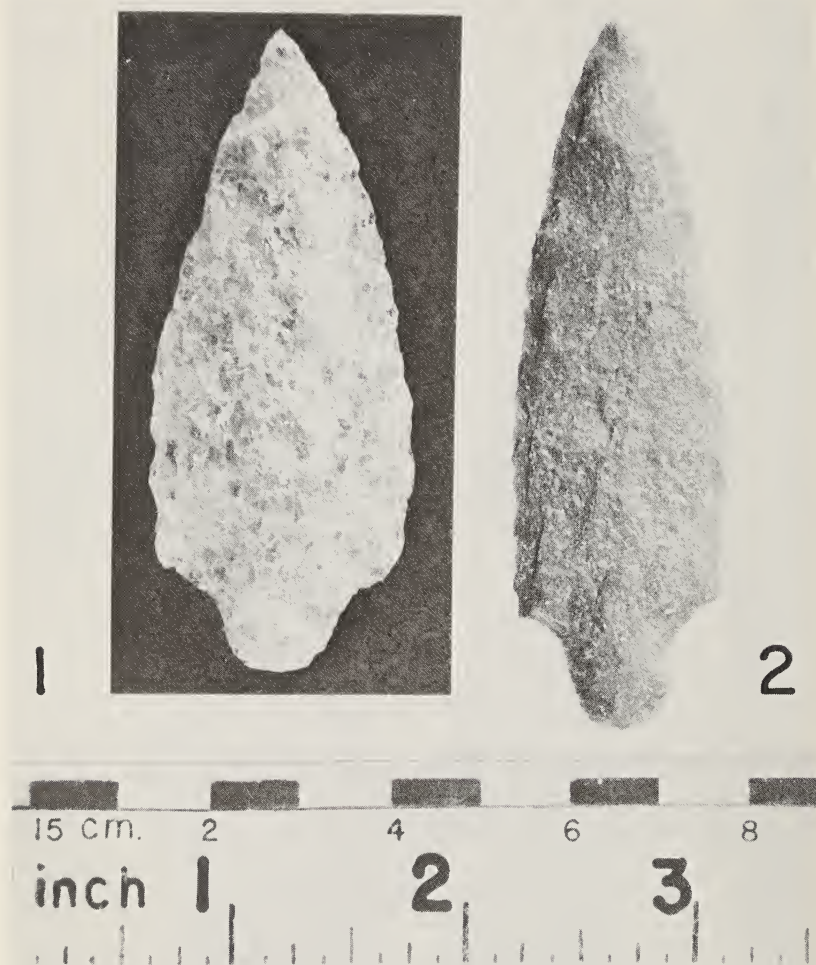


PLATE 25—POPLAR ISLAND POINTS

1, 2, Van Orden site, Greene County, N. Y.

Collection of Carl S. Sundler.

Material: quartzite.

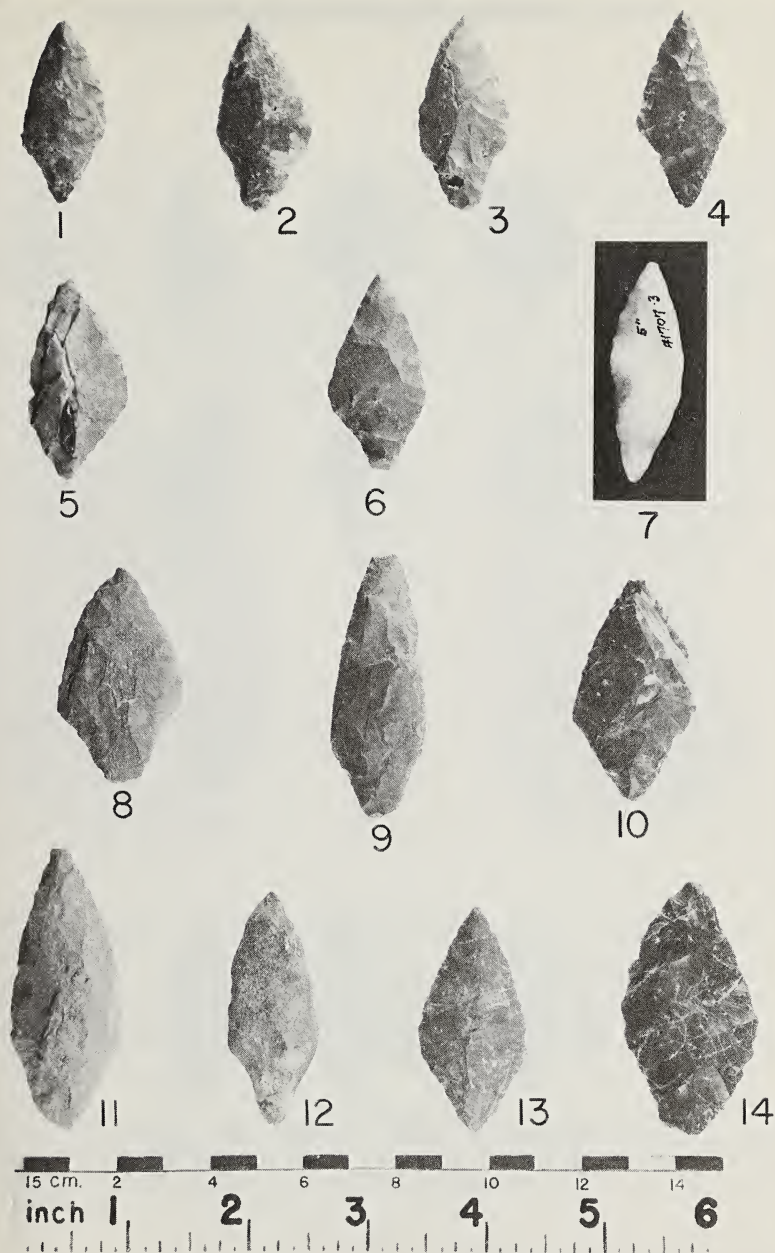


PLATE 26—ROSSVILLE POINTS

1, 5, 12, Bannerman site, Dutchess County, N. Y.; 2-4, 6, 8-11, 13, 14, Van Orden site, Greene County, N. Y.; 7, Stony Brook site, Suffolk County, N. Y.

1, 5, 7, 12, collection of N. Y. State Museum; others Carl S. Sundler collection.

Material: 1, 3, 6, 8-10, 13, 14, Deepkill flint; 2, 4, Fort Ann flint; 7, quartz; 11, 12, argillaceous siltstone.

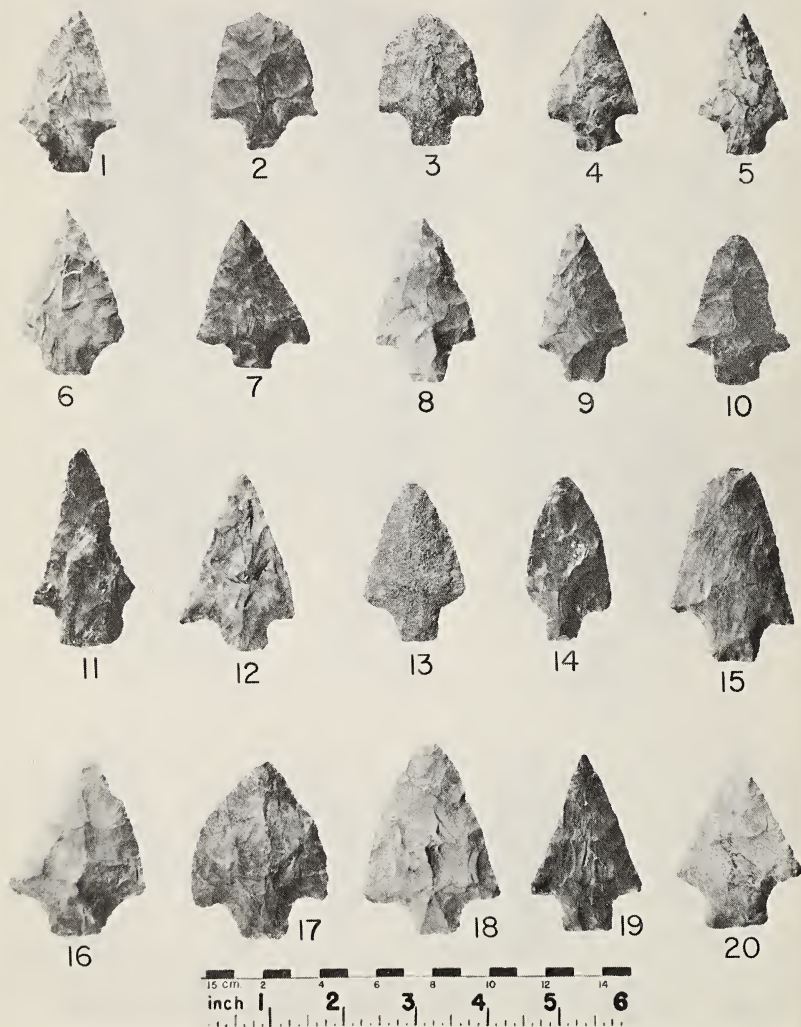


PLATE 27—SNOOK KILL POINTS

Weir site, Rensselaer County, N. Y.

Collection of James H. Zell.

Material: 1, 2, 4-8, 10-12, 15-20, Normanskill flint; 3, Oriskany flint; 9, 14, Onondaga flint; 13, argillite.

NEW YORK PROJECTILE POINTS

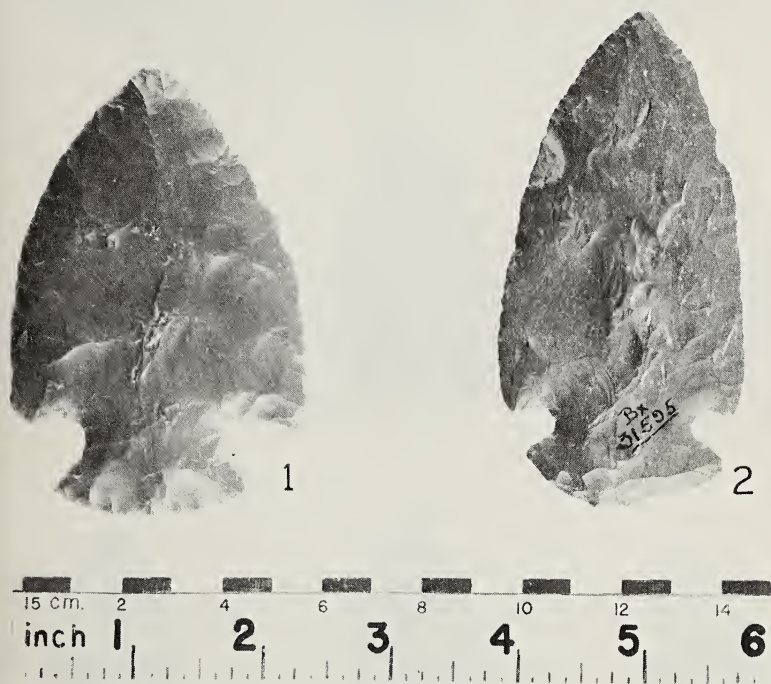


PLATE 28—SNYDERS POINTS

1, Portageville, Livingston County, N. Y.; 2, Seneca River, Onondaga County, N. Y.
Collection of N. Y. State Museum.

Material: 1, Harrison County, Ind. flint; 2, Onondaga flint (?).

PLATE 29—STEUBENVILLE LANCEOLATE POINTS

1-3, 5, 6, 8, Ford site, Columbia County, N. Y.; 4, Four Mile Point, Greene County, N. Y.; 7, Van Buren, Onondaga County, N. Y.; 9, Clifton Park, Saratoga County, N. Y.

1-3, 6, collection of Edward B. Christman; 4, 7, 9, N. Y. State Museum collection; 5, 8, collection of R. Arthur Johnson.

Material: 1, 2, 6, Deepkill flint; 3, 5, 9, Normanskill flint; 4, 8, argillite; 7, Oriskany flint.

NEW YORK PROJECTILE POINTS



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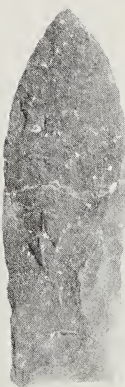
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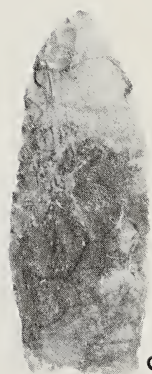
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9



PLATE 30—STEUBENVILLE STEMMED POINTS

1-3, 6, 7, Ford site, Columbia County, N. Y.; 4, Four Mile Point, Greene County, N. Y.; 5, Roger's Island, Columbia County, N. Y.; 8, Coh. 9 site, Rensselaer County, N. Y.; 9, Seneca River, Onondaga County, N. Y.

1, 3, 6, 7, collection of Edward B. Christman; 2, 4, 5, 9, collection of N. Y. State Museum; 8, collection of Carl S. Sundler.

Material: 1, 3, Deepkill flint; 2, 6, argillite; 4, Oriskany flint; 5, 8, Normanskill flint; 7, 9, Onondaga flint.

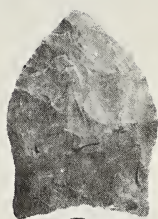
NEW YORK PROJECTILE POINTS



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4



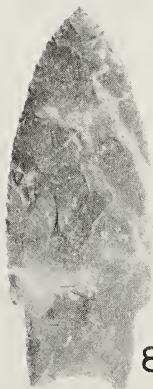
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8



9



PLATE 31—SUSQUEHANNA BROAD POINTS

1-3, Seneca River, Onondaga County, N. Y.; 4, 6, 10, New Berlin, Chenango County, N. Y.; 5, 7, 8, Chemung County, N. Y.; 9, 11, Lysander, Onondaga County, N. Y. Collection of N. Y. State Museum.

Material: 1-3, 9, 11, Onondaga flint; others rhyolite.

NEW YORK PROJECTILE POINTS

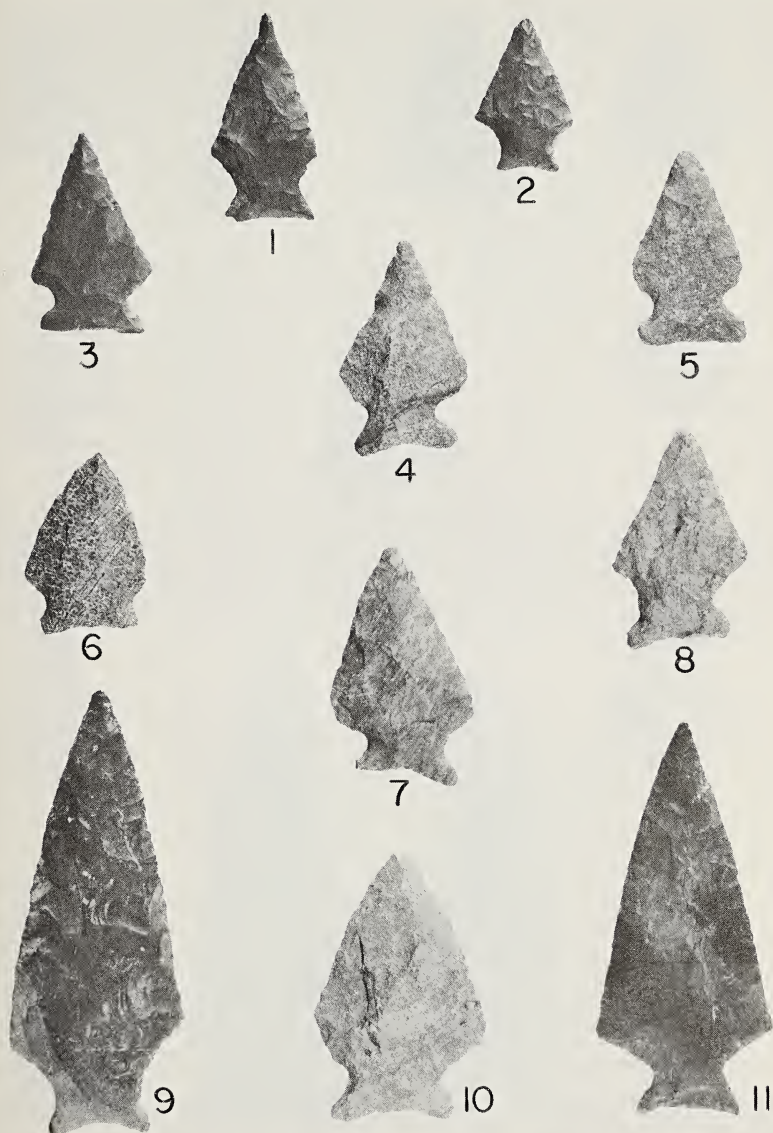
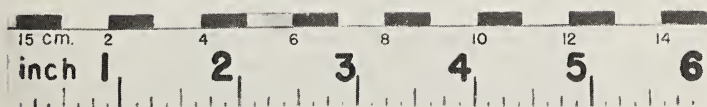
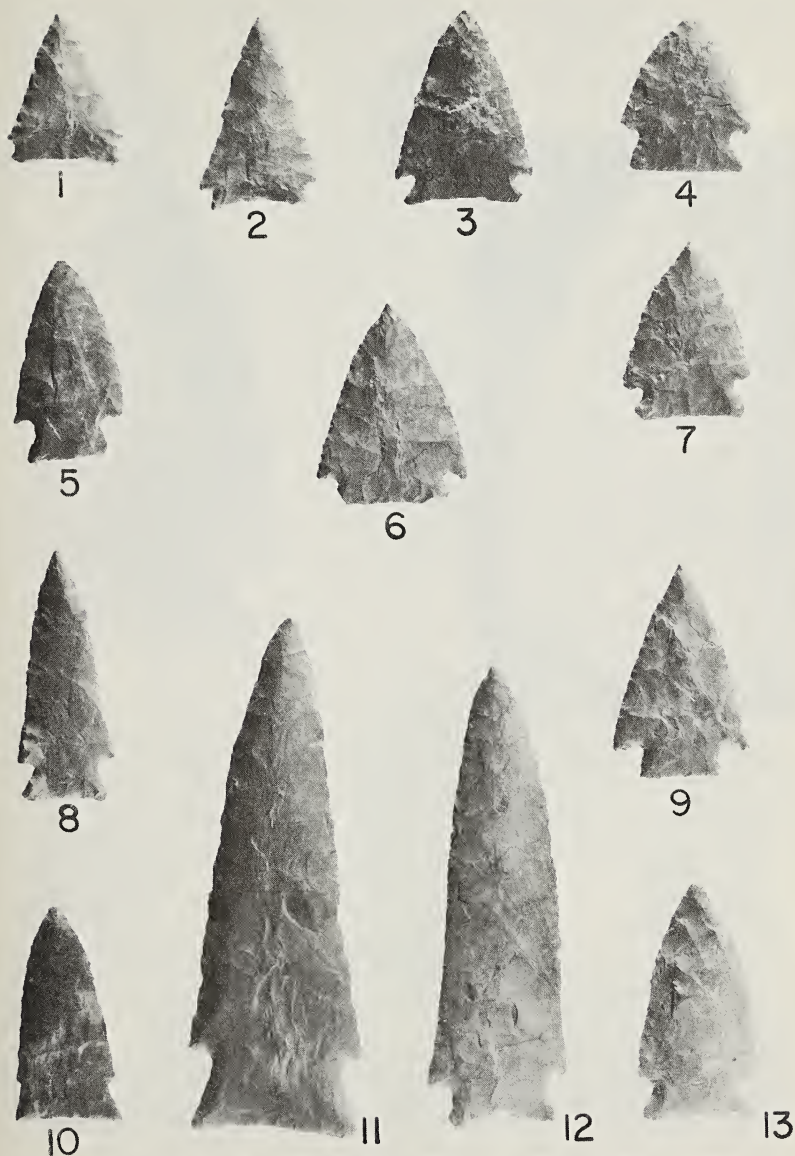


PLATE 32—VOSBURG POINTS

1, Covered Bridge site, Albany County, N. Y.; 2, 5, 10, Dunsbach Ferry site, Albany County, N. Y.; 3, 11, Glens Falls, Warren County, N. Y.; 4, 7, 13, Van Orden site, Greene County, N. Y.; 6, Onondaga County, N. Y.; 8, Coxsackie Flint Mine, Greene County, N. Y.; 9, Vosburg site, Albany County, N. Y.; 12, Four Mile Point, Greene County, N. Y.
1, 2, 4, 5, 7, 9, 10, 13, collection of Carl S. Sandler; others N. Y. State Museum collection.
Material: Deepkill and Normanskill flints.

NEW YORK PROJECTILE POINTS



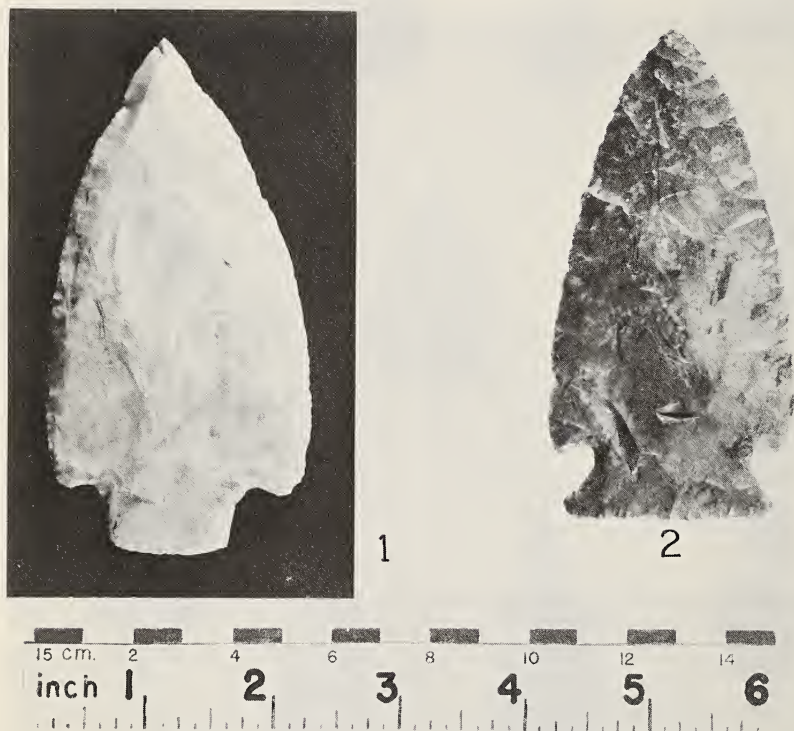


PLATE 33—POINTS OF EXOTIC FLINT

1, broad-bladed, thin, straight stemmed point, from Seneca River, Onondaga County, N. Y. This is apparently an undesignated point form of the Adena culture, which occurs also in the related Middlesex complex of the Northeast (see Ritchie and Dragoo, 1960, plate 8, figures 1, 2, 4, 5).

2, broad-bladed, thin, corner-notched point from the Genesee Valley of western N. Y. It seems to be an unusually large example of the Jack's Reef Corner-Notched type (see plate 11). Similar specimens are found in Hopewell culture sites of Ohio and elsewhere.

Material: Both points are made of Flint Ridge, Licking County, Ohio chalcidony.

NEW YORK PROJECTILE POINTS

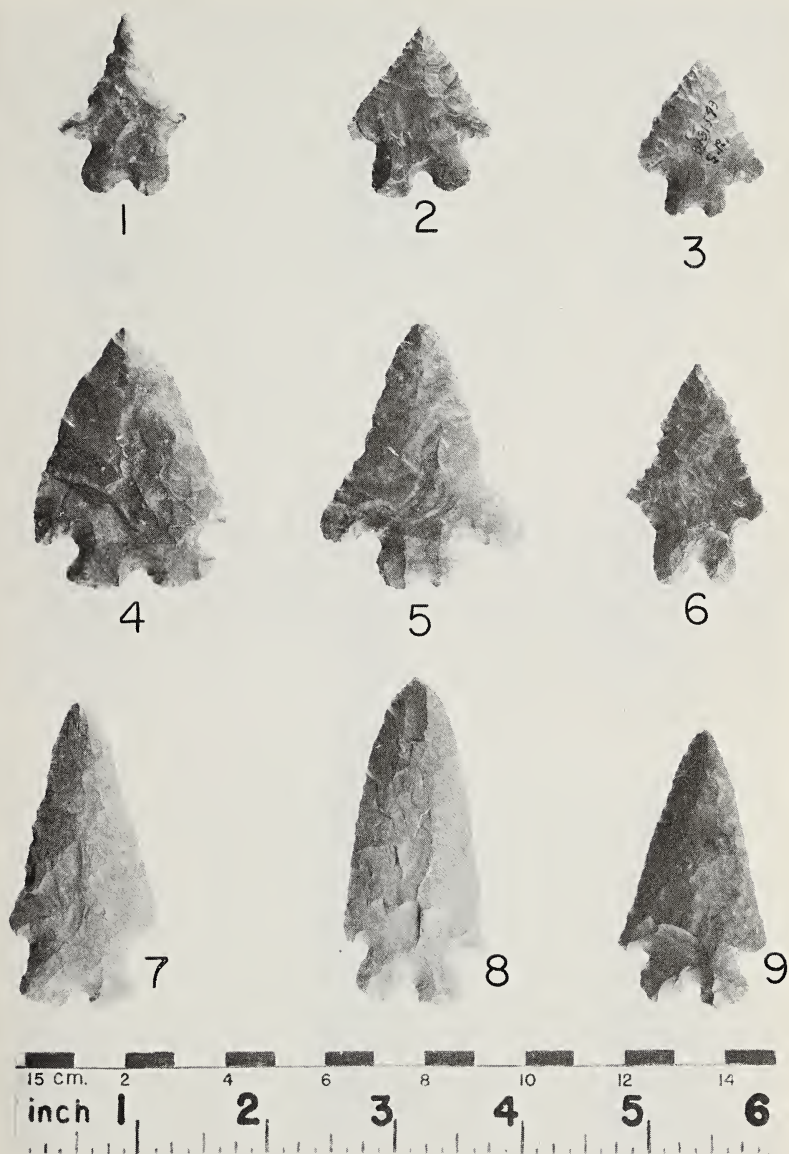


PLATE 34—UNTYPED BIFURCATED BASE POINTS

1, 3-5, 7, 9, Onondaga County, N. Y.; 2, Van Orden site, Greene County, N. Y.; 6, Bannerman site, Dutchess County, N. Y.; 8, Lysander, Onondaga County, N. Y.
 2, collection of Carl S. Sundler; others N. Y. State Museum collection.
 Material: 1, Flint Ridge, Ohio chalcedony; 2, 6, Deepkill flint; others Onondaga flint.

PLATE 35—UNTYPED NARROW TRIANGULAR POINTS

1, 6, Coh. 9 site, Rensselaer County, N. Y.; 2, 3, Round Lake, Saratoga County, N. Y.; 4, Clifton Park, Saratoga County, N. Y.; 5, West Albany, Albany County, N. Y.; 7, Elbridge, Onondaga County, N. Y.; 8, Fish Creek, Saratoga County, N. Y.

1, 5, 6, Carl S. Sandler collection; others N. Y. State Museum collection.

Material: 1, 4, Normanskill flint; 2, 3, 5, 8, Deepkill flint; 6, 7, Onondaga flint.

NEW YORK PROJECTILE POINTS



1



2



3



4



5



6



7



8

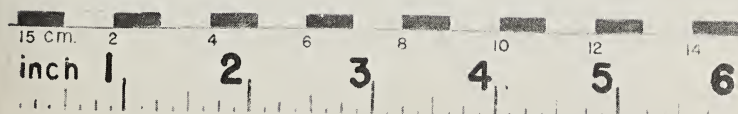


PLATE 36—UNTYPED BROAD-BLADED, STEMMED POINTS

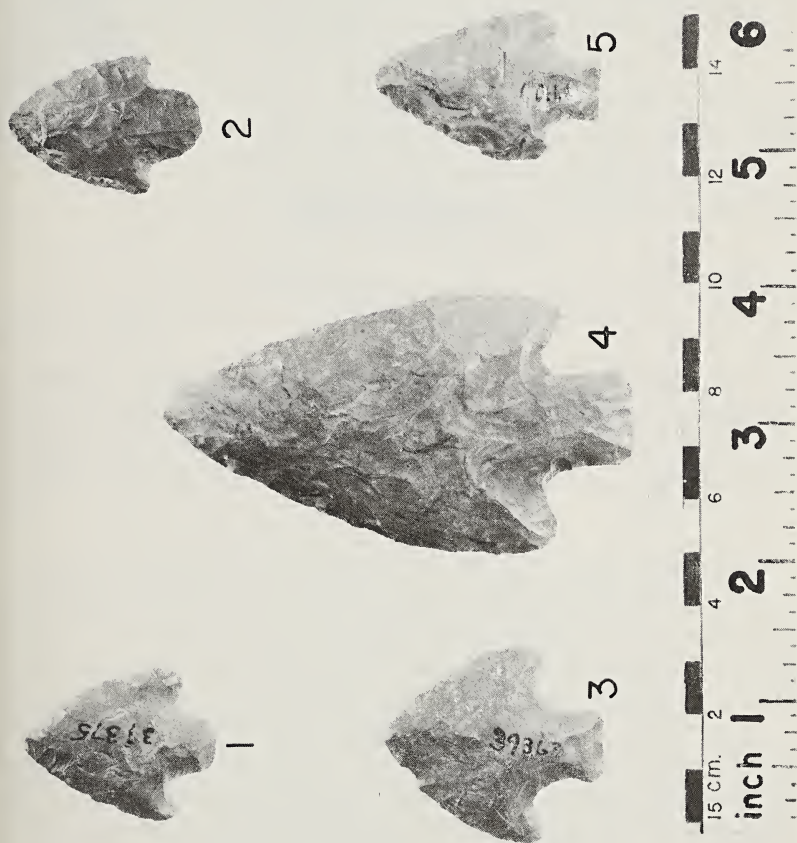
Numbers 1 and 2, especially, resemble Snook Kill points (plate 27), and the group as a whole may represent a variant of this probably Late Archaic type.

1, Fish Creek, Saratoga County, N. Y.; 2, Stillwater, Saratoga County, N. Y.; 3, Clifton Park, Saratoga County, N. Y.; 4, Seneca River, Onondaga County, N. Y.; 5, Van Orden site, Greene County, N. Y.

5, collection Carl S. Sundler; others N. Y. State Museum collection.

Material: 1-3, 5, Deepkill flint; 4, Onondaga flint.

NEW YORK PROJECTILE POINTS



APPENDIX

Ten New Projectile Point Types

BEEKMAN TRIANGLE POINTS

Description prepared by Robert E. Funk



General description: Convex- or straight-sided triangular points with straight or concave bases, generally well-chipped, of small to medium size.

Size: Range in length is $1\frac{3}{16}$ to $1\frac{5}{8}$ inches, most being $1\frac{5}{16}$ to 1 inch long. Width varies from $1\frac{1}{16}$ to $1\frac{7}{16}$ inches, the majority having a width of $\frac{5}{8}$ – $\frac{7}{8}$ inch. Thickness is generally between $\frac{3}{16}$ and $\frac{1}{4}$ inch.

Proportions: These points are usually as broad as long.

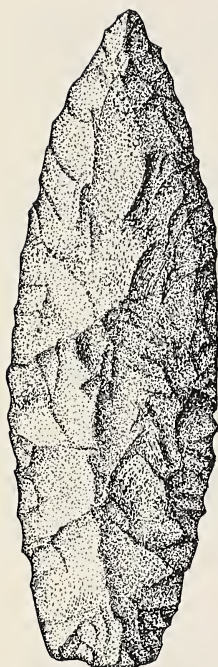
Shape: Most approach the equilateral triangle in outline, but a few are isosceles triangular. Edges are usually excurvate, sometimes straight, rarely recurvate. Bases are usually slightly concave, less often straight, and in a majority of cases display slight to moderate grinding.

Age and cultural affiliations: The type is confined to the Archaic stage in New York State, where it has been found in Laurentian contexts. It appears most frequently in the Vosburg phase, and seems to be a rare form on Brewerton components. The type description is based mainly on the sample from lower levels of Stratum 2 at the Sylvan Lake Rockshelter, Dutchess County (Funk, 1965; n.d.). A radiocarbon date of 2524 B.C. $\pm$ 300 years (M-287) has been attributed to the Vosburg assemblage at the Bannerman site (Ritchie, 1958, p. 67), and the Vosburg habitation of the Sylvan Lake Rockshelter is C-14 dated at 2780 B.C. $\pm$ 80 years (Y-1535).

Distribution: Specimens of the type have been observed in eastern New York from Lake George to the New York metropolitan area. The type occurs as far west as Brewerton, but the limits of its distribution to the east, north, or south of the Hudson Valley are not known. It seems to overlap in morphology and in temporal and cultural provenience with the Squibnocket Triangle of Martha's Vineyard (Ritchie, 1969).

GREENE POINTS

Description prepared by Robert E. Funk



General description: Lanceolate or tapered-stem points, of medium breadth, with straight or slightly rounded bases.

Size: Length ranges from 2 to 4 inches, predominantly $2\frac{1}{4}$ – $2\frac{3}{4}$ inches. Breadth varies from $\frac{7}{8}$ to $1\frac{1}{2}$ inches, the majority measuring close to 1 inch. Thickness range is $\frac{1}{4}$ to $\frac{3}{8}$ inch, the majority being $\frac{3}{8}$ inch thick.

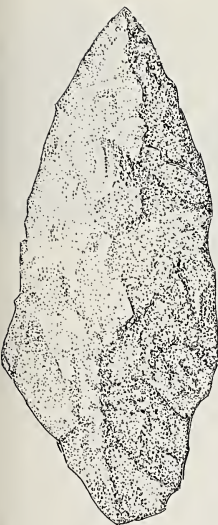
Proportions: Greene points are $2\frac{1}{4}$ to $2\frac{1}{2}$ times longer than wide.

Shape: Blade lanceolate in outline, with greatest width at or just forward of mid-point. Biconvex in cross section. Lower edges usually taper gently to flat or slightly rounded base. Less often there are weak shoulders above a tapering stem. Rarely the lower edges are lightly rubbed. The points are frequently well-flaked and invariably symmetrical.

Age and cultural affiliations: Late Middle Woodland in eastern New York. Their first recorded appearance is in the Fox Creek phase, C-14 dated between A.D. 360 and 450; they persisted into later Middle Woodland times, vanishing about A.D. 800 with the onset of strong influences from the Kipp Island phase of central New York (Funk, n.d.).

Distribution: Predominantly the middle Hudson Valley, but sporadic examples have been observed in collections throughout the valley. The type also occurs in the Schoharie Valley. A small number of Greene points were recovered from the lowest levels of the Cunningham site, Martha's Vineyard, C-14 dated at A.D. 400 ± 80 years (Y-1533), by Ritchie (1969), in association with Fox Creek points and Middle Woodland ceramics, indicating a continuous distribution through southern New England.

LAGOON POINTS



General description: Narrow, thick, rather crudely made, lobate stemmed points, of medium to large size.

Size: Length range from about $1\frac{7}{8}$ to 3 inches, median about $2\frac{1}{4}$ inches. Thickness of majority around $\frac{3}{8}$ of an inch.

Proportions: About $2\frac{1}{2}$ to 3 times as long as wide.

Shape: Blade trianguloid in outline, biconvex in cross section; edges straight or slightly excurvate. Shoulders weak, rarely moderately well defined, merging into contracting, medium long to long stem, lobate in outline, with convex or slightly squarish base. No base or stem grinding.

Age and cultural affiliations: Our Martha's Vineyard excavations relate this type to the Early Woodland horizon, radiocarbon dated on the Pratt site at 520 B.C. $\pm$ 120 years (Y-1531) and 430 B.C. $\pm$ 80 years (Y-1532) (Ritchie, 1969). There are definite morphological similarities linking Lagoon and Adena points as found in New York State on Early Woodland sites.

Distribution: The type is fairly common and widely distributed over southern New England, but it has not previously been described or culturally attributed there.

In the artifact classification system of the Massachusetts Archaeological Society the Lagoon point has its closest evident parallels in the Corner-Removed category, numbers 3 and 9 (Fowler, 1963, pp. 2-4).

In eastern and southern New York, the Lagoon point occurs in Early Woodland contexts on sites in the Hudson Valley and on Long Island.

References: Ritchie, 1958, pp. 100-101, 106-107; 1959, pp. 33, 44, 120-121, where it has been termed the "lobate stemmed point"; 1969, p. 245.

Remarks: This point type was probably the armature of the javelin or short throwing spear. A bar type atlatl weight formed part of the context on the Pratt site (Ritchie, 1969).

The Lagoon point appears to have been coarsely fabricated by percussion chipping techniques. Pressure flaking to produce retouched edges is lacking. The Martha's Vineyard sample consists of felsite and rarely of quartz, derived from local glacial pebbles. Long Island specimens are mainly of quartz; flint, quartz, graywacke, and other materials were employed for its manufacture in the Hudson Valley.

LONG BAY POINTS and PORT MAITLAND POINTS



It is possible to recognize as distinctive and to allocate culturally and temporally two point forms to be provisionally designated as new types, namely, Long Bay points and Port Maitland points. Available samples of both styles are, however, insufficient for formal descriptions involving the usual metrical data. Therefore only general descriptions will be offered at this time.

Both point styles pertain to the Point Peninsula culture of the Middle Woodland stage. The Long Bay point appears earlier in time as the characteristic weapon point of the early Point Peninsula, Canoe Point phase, radiocarbon dated in central New York at A.D. 240 ± 80 years (Y-1277) (Ritchie, 1965, pp. 203-213). It persisted, however, into the later Point Peninsula, Kipp Island phase, radiocarbon dated at A.D. 630 ± 100 years (Y-1379) in the same area. On some sites of this phase it coexisted with the Port Maitland form (Ritchie, 1965, pp. 228-253).

The Long Bay type may be described as a generally thin, well-made, side-notched point, with slightly convex or straight base (see illustrations in Ritchie, 1965, Plate 82, figures 7, 8, 13, 14). The Port Maitland form is a very thin, extremely well-made, side-notched point, with broad, slightly concave or straight base, and a pronounced square tang and notches (see illustrations in Ritchie, 1965, Plate 81, figures 26, 27, 30, 31, 35, 36).

SQUIBNOCKET STEMMED POINTS



General description: Small, thick, very narrow, drill-like points, with markedly tapered stems.

Size: From about $\frac{7}{8}$ of an inch to about 2 inches in length. Most are around $1\frac{1}{4}$ inches long. Thickness varies from $\frac{3}{16}$ to $\frac{5}{16}$ of an inch, with the majority being about $\frac{1}{4}$ of an inch in maximum thickness.

Proportions: Range from approximately $2\frac{1}{2}$ to 3 times as long as wide.

Shape: Blade in most cases nearly spike-shaped, with slightly excurvate edges and thick, lenticular cross section. Shoulders weak or nonexistent. Long, tapering stem, terminating in a bluntly pointed or narrow rounded base. No grinding.

Age and cultural affiliations: In our Martha's Vineyard excavations this type was localized in Stratum 3 at the Hornblower II site, where it was definitely associated with the Wading River and Squibnocket Triangle types in what I have defined as the Squibnocket complex of the Late Archaic stage, carbon-14 dated here to 2190 B.C. $\pm$ 100 years (Y-1529) (Ritchie, 1969).

Distribution: A common southern New England point type, found also on Long Island.

References: It is usually grouped with the "small stemmed" points of New England, although some specimens would probably be referred to the "tapered stem" group of the Massachusetts classification (Robbins, 1960, pp. 40-41, 42; Fowler, 1963, pp. 1, 3; Ritchie, 1969, p. 243).

Remarks: This is probably a Late Archaic form wherever it occurs and it may be considered a variant of the Wading River point. Like the latter, it is usually made of quartz, evidently by percussion chipping.

SQUIBNOCKET TRIANGLE POINTS



General description: Small triangular points with convex edges and generally concave bases.

Size: Length range is approximately from $\frac{3}{4}$ inch to $1\frac{1}{2}$ inches, with most of the specimens measuring between 1 and $1\frac{1}{4}$ inches. Width variation is about $\frac{1}{2}$ to $\frac{7}{8}$ of an inch, with around $\frac{5}{8}$ of an inch for the majority. Thickness measures between $\frac{1}{8}$ and $\frac{5}{16}$ of an inch, $\frac{1}{8}$ to $\frac{3}{16}$ for the most part.

Proportions: Varies from about $2\frac{1}{2}$ times as long as wide to about as long as wide; most examples are approximately $1\frac{1}{4}$ to $1\frac{1}{2}$ times as long as wide.

Shape: Equilateral or isosceles triangular in outline, biconvex in cross section; edges predominantly convex, rarely straight or pentagonoid; base predominantly concave, rarely straight. No basal or edge grinding.

Age and cultural affiliations: This type was found on the Hornblower II site, where it was concentrated in Stratum 3 as a definite trait of the Squibnocket complex, carbon-14 dated there at 2190 B.C. $\pm$ 100 years (Y-1529), and in Stratum 3B at the Vincent site (Ritchie, 1969). The type is also present at the Wading River site on Long Island in association with Wading River points (Ritchie, 1959).

Distribution: A common and widely distributed southern New England point, found also in southeastern and southern New York, especially on Long Island. It is included in the "small triangular" point category of New England archaeologists.

References: Robbins, 1960, p. 40; Fowler, 1963, pp. 1, 3; Ritchie, 1959, pp. 84-85; 1969, p. 244.

Remarks: Several subtypes of this point are recognized in Massachusetts and our Martha's Vineyard and Long Island points conform to these. There is, however, no evidence to show that these variations on a basic form have either cultural or temporal significance. They occurred together at the Hornblower II and Vincent sites. The material from which these points were made, apparently by percussion chipping, is in a vast majority of cases white quartz from local glacial pebbles.

In the Hudson Valley the Beekman Triangle point seems to represent a modal variant of the Squibnocket Triangle, from which it differs in more often having a straighter base, less excurvate sides, a more marked isosceles shape and greater length, also in being predominantly chipped of flint. Some points of both types bear a close resemblance and there is a definite intergrading of the two series (Funk, herein). In the Hudson Valley the Beekman Triangle is a Laurentian trait.

SYLVAN SIDE-NOTCHED POINTS

Description prepared by Robert E. Funk



General description: Small to medium sized, thick, broad, sloppily manufactured side-notched points.

Size: Length ranges from $1\frac{1}{16}$ to $2\frac{3}{16}$ inches, the mode being $1\frac{3}{8}$ – $1\frac{1}{2}$ inches. Breadth ranges from $\frac{5}{8}$ – $1\frac{1}{16}$ inches, generally falling within $\frac{3}{4}$ – $\frac{7}{8}$ inch. The usual thickness is $\frac{1}{4}$ – $\frac{3}{8}$ inch.

Proportions: Length averages $1\frac{3}{4}$ to 2 times greater than breadth.

Shape: Blade usually ovoid in outline, rarely trianguloid. Cross section is biconvex. Side-notching usually broad and shallow, frequently asymmetrical. Base straight or convex, not ground. These points are rudely chipped by percussion.

Age and cultural affiliations: There appears to be some morphological overlap with Brewerton Side-Notched points. Sylvan Side-Notched points are rare to absent in Laurentian components in eastern New York, but are characteristic of the late Archaic Sylvan Lake complex, in which they occur as a minority type. The type assemblage for the complex was present in Stratum 2 at the Sylvan Lake Rockshelter, Dutchess County (Funk, 1965; n.d.). Age ranges between approximately 2200 and 1500 B.C., based on radiocarbon dates for the Sylvan Lake shelter and for similar manifestations in New England (Ritchie, 1965a; 1969).

Distribution: Principally eastern New York. Examples of the type have been seen by the writer in collections from Connecticut, and it appears to be a rare form in the Bare Island complex of Pennsylvania (Kinsey, 1959).

VESTAL NOTCHED POINTS

Description prepared by David R. Wilcox



General description: Small, broad, and thin side- or corner-notched points.

Size: In a sample of 452 points, the length range is from $1\frac{1}{16}$ to $1\frac{7}{8}$ inches, the average length $1\frac{3}{16}$ inches. Maximum breadth ranges from $\frac{1}{2}$ to $1\frac{7}{16}$ inches and averages $\frac{3}{4}$ of an inch. Average width of neck $\frac{7}{16}$ of an inch, of base $\frac{9}{16}$ of an inch. Average thickness $\frac{3}{16}$ of an inch. Average weight 2.5 grams.

Proportions: $1\frac{1}{2}$ times as long as wide.

Shape: Blade triangular in outline and biconvex in cross section, with straight or slightly convex edges. Shoulders often slightly barbed, always broader than base, which is usually slightly convex or straight. 6.4 percent of sample had unfinished base, 13.7 percent had some basal grinding.

Age and cultural affiliations: Occurred in definite association with Lamoka points in midden and several pits at Castle Gardens site, Broome County, N.Y. A radiocarbon date on charcoal from one such pit was 2140 B.C. $\pm$ 100 years (Y-2347).

Distribution: As presently known, the center of distribution lies in the upper Susquehanna Valley. Of the sample studied, 314 points were surface finds within a 3 mile radius of Afton, N.Y. made by Jesse Benton of Binghamton, N.Y., the remaining 138 are from the Castle Gardens site, found in the excavations of the New York State Museum and Science Service in 1967, those of Harpur College in 1966, or on the surface by Murray Shapiro of Endicott, N.Y.

References: Wilcox, n.d.

Remarks: As the spacio-temporal relationships of this point are still unknown, it is best to regard it as a tentative type of the Late Archaic stage.

WADING RIVER POINTS



General description: Small, narrow, stemmed points.

Size: Length range 1 to 2 inches. In a typical sample of 50 specimens from the Hornblower II and Wading River sites, 80 percent fall between $1\frac{1}{4}$ and $1\frac{5}{8}$ inches, 46 percent between $1\frac{3}{8}$ and $1\frac{1}{2}$ inches, and only 5 percent between $1\frac{3}{4}$ and 2 (one example) inches, and 5 percent between 1 and $1\frac{1}{8}$ inches.

The thickness varies from $\frac{1}{2}$ to $\frac{3}{8}$ of an inch in the same sample. Only the longest point (2 inches) measured $\frac{1}{2}$ inch, 86 percent were distributed about evenly between $\frac{1}{4}$ and $\frac{5}{16}$ of an inch, while 12 percent measured $\frac{3}{8}$ of an inch in maximum thickness.

Proportions: About 2 to $2\frac{1}{4}$ times as long as wide.

Shape: Blade triangular in outline, biconvex in cross section; edges straight or slightly excurvate. Shoulders weak to moderately well pronounced, but generally poorly defined, oblique and merging into the relatively long, squarish stem. Base straight or slightly convex, appearing thick, rough and "unfinished" in about $\frac{1}{3}$ of the specimens. No grinding on stem or base.

Age and cultural affiliations: The Martha's Vineyard representation of this type pertained intrinsically to Strata 1B and 3 of the Hornblower II site, the latter securely radiocarbon dated to 2190 B.C. $\pm$ 100 years (Y-1529) attributed to the Squibnocket complex of the Late Archaic stage (Ritchie, 1969). At the Wading River site on Long Island, it was the principal trait of a Late Archaic assemblage which can be equated with the Sylvan Lake complex of eastern New York, a contemporaneous manifestation (2210 B.C. $\pm$ 140 years) (Y-1536) with the Squibnocket complex on Martha's Vineyard (Ritchie, 1959; Funk, 1965).

Distribution: This point type is common and widely distributed over southern New England (Massachusetts, Connecticut, Rhode Island) and it occurs farther north, especially in the Connecticut Valley.

The type is also well represented in eastern and southern New York, and it ranges southward through eastern Pennsylvania into the Middle Atlantic area.

References: It constitutes the principal element in the category of "small stemmed" points of New England archeologists and has been widely illustrated and referred to under that name (see, for example, Robbins, 1960, pp. 40-41; Fowler, 1963, pp. 1, 3). The writer has discussed this point type and its relation to other narrow-bladed point forms in a recent paper (Ritchie, 1965a). In this publication the writer has proposed the type name "Wading River" point because he first excavated a complex dominated by this point form on the Wading River site on Long Island (Ritchie, 1959, pp. 78-88; 1969, pp. 241-242).

Remarks: The vast majority of Wading River points are made from quartz pebbles, evidently by direct percussion chipping. The relatively few examples composed of other materials, especially those of flint, are better made, thinner and more symmetrical.

This point type intergrades with the Bare Island point, from which it is to be distinguished chiefly by its smaller size, the average length of the Bare Island type being slightly over 2 inches (Ritchie, herein, pp. 14-15), of the Wading River type slightly over $1\frac{3}{8}$ inches. It also has some typological affinities with the stemmed variety of the Lamoka point, especially in those specimens having a rough, "unfinished" base, preserving traces of the rind of the pebble from which they were fashioned (Ritchie, herein, pp. 29-30).

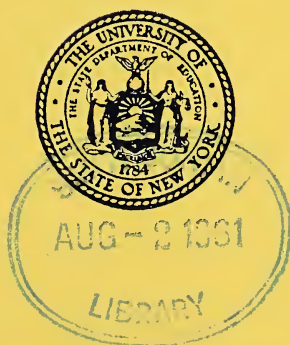
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ANNUAL REPORT

of the

NEW YORK STATE MUSEUM AND SCIENCE SERVICE

July 1, 1959—June 30, 1960



NEW YORK STATE MUSEUM AND SCIENCE SERVICE

MUSEUM BULLETIN NUMBER 385

**The University of the State of New York
The State Education Department
Albany, 1961**

122d ANNUAL REPORT

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Contents

	PAGE
General Statement	7
Accomplishments of the Surveys.....	13
The Museum	31
Special Services	55
Publications	60
Appendixes	64

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STANLEY J. SMITH.....Associate Curator (Botany)
JOHN A. WILCOX.....Associate Curator (Entomology)
VACANT.....Associate Curator (Interpretation)

Exhibits

EDITH FROELICH.....Museum Technician (Temporary)
LEWIS E. KOHLER.....Museum Technician
LOUIS J. KOSTER.....Senior Museum Technician
ROBIN ROTHMAN.....Museum Technical Apprentice (Temporary)
THEODORE P. WEYHE.....Museum Exhibits Designer

School Services

JUDITH A. DRUMM.....Museum Instructor
MARY JANE STAUCH.....Museum Instructor (Temporary)
JANET L. STONE.....Museum Education Supervisor

Library

EILEEN COULSTON.....Librarian, Junior Scientist

Clerical

MARGARET BASSOTTI.....Stenographer
MARION B. BENDER.....Clerk
JOAN A. CREECH.....Stenographer
EMILY W. DIXON.....Typist
JOSEPH T. KILLEA.....Mail and Supply Helper
ROSELLE LITHGOW.....Clerk
MARJORIE R. SCHMIDT.....Principal Clerk
MARGARET SLATER.....Senior Stenographer
MARY C. STEARNS.....Stenographer
EILEEN A. WOOD.....Senior Stenographer

Guards

JAMES CARROLL.....Museum Guard
JOHN C. CUNNINGHAM.....Museum Guard
FRANCIS J. LYNCH.....Museum Guard
WILLIAM C. ZIMMER.....Museum Caretaker

Photographer

JOHN HELLER.....Museum Photographer

NELSON D. POWERS.....Maintenance Helper
JACOB SMALLENBROEK.....Carpenter
JAMES WIEDEMANN.....Maintenance Man (Carpenter) (Temporary)

General Statement

I HAVE THE HONOR TO SUBMIT a report of the major activities and accomplishments of the New York State Museum and Science Service for the year ended June 30, 1960. The activities of the year covered by the 122d Annual Report are best expressed in the individual reports of the scientists and Museum curators, the exhibits and the educational staff. My own report of stewardship of these activities reiterates programs that I have proposed in staff conferences and accomplishments reported to the Commissioner.

Because I believe that research museums such as ours are essentially communities of scholars, considerations of the staff take first precedence. As I have written elsewhere, it is the essential character of the research museum that collections accumulate as a byproduct and directly reflect the research interests of scientists. As the years go by and scientific collections grow, they then become a resource for research, the museum attracts scientists, and it attains stature proportionate to its resources and its publications. A public museum is, moreover, an outgrowth of its own services. Reputations of museums are ephemeral and must be constantly validated. As long as a museum maintains a research program and continues to publish, it will hold its staff and its reputation in the scientific community. It is important, therefore, that we give some consideration to the labor market for museum scientists.

Salaries are rising for academic posts in universities having similar qualifications as curators in the State Museum and scientists in the Surveys of the State Science Service. We can no longer meet the competition for new personnel nor are we promoting seasoned scientists so rapidly as the universities. Recently, the directors of 22 leading science museums have urged the adoption of standards for classification and salaries of curatorial positions in research museums equivalent with academic grades and titles in nearby colleges and universities, so that curators equal full professors; associate curators, associate professors; and assistant curators, assistant professors. For two years a plan has been advanced to the Department requesting that our top professional positions be raised to meet the competition of full professors who are chairmen of departments in universities, and our top research scientists should equal the salary level of teaching professors.

The Establishment

The Department has taken a long stride forward in providing new laboratories for the scientists of the State Science Service. The addition of the wing to the Education Department is, for the Museum, the first extension of its facilities since the Museum was originally opened in the present building. The new laboratories occupy the ninth floor of the wing and are connected to the fifth floor of the Education Building at the back of Biology Hall by a bridge. The arrangement of the laboratories and offices is the work of a committee which was headed by Dr. John G. Broughton, State geologist, who spent a considerable part of three years in planning the laboratories and selecting suitable equipment. The laboratories which were nearing completion in June were entirely financed and furnished by the State of New York. Grateful acknowledgment is made to Deputy Commissioner E. B. Nyquist for advancing our claim and to the Division of the Budget for awarding the funds. Elsewhere in the report we express regret that a team from the National Science Foundation which looked over our facility did not make us an additional grant from its facilities fund to purchase cases for the collections that have been dislocated by the move and to provide subprofessional help for the curators. They did, however, express admiration and approval of what we had accomplished with our own resources.

The Museum

Attention is called to the report of the Museum which indicates that attendance has declined from a high of 175,000 last year by some 16½ percent. Various theories have been advanced for this decline: It has been ascribed to a shift in statistical methods, it has been ascribed to a change in travel patterns of the American public, and it may be owing to other factors beyond our ken. One thing is certain: In the next year we must undertake a survey of our visitors to ascertain their origins, whether they come back repeatedly, what age groups of the population they represent and what sectors of the taxpayers are being served by the Museum as an educational facility.

Visitors returning to the Museum after several years remark on the very real progress with exhibits. This section of the report speaks for itself.

We are particularly proud of the new herbarium which was created at the rear of Biology Hall adjacent to the new wing. This gain in research space meant a loss of exhibit space, but it was accompanied by an improvement in the bird and mammal exhibits. Although the workspace

may not be the botanists' ideal, at least we have the only herbarium in the civilized world that has glass cases filled with domestic poultry visible to both guests in the exhibit halls and to botanists within the herbarium!

State Museum Advisory Council

The plight of cities is reflected in the inability of the present tax base to support educational programs of city museums over and above the need of the public schools, and the museums in our large metropolitan centers are serving wider audiences of school children than the narrow area of municipal tax support. This situation was called to the attention of the reading public last winter in a series of editorials in the *New York Times*. At its spring meeting, the State Museum Advisory Council recognized this problem and recommended three things: a new set of regulations for chartering museums, a definition of "museum" to serve as the basis for new legislation to protect educational establishments from encroachment by the entertainment industry, and the establishment of a Commissioner's Committee on Museum Resources. Simultaneously, the council and its invited guests, who were directors of representative museums in all parts of the State, commenced a movement to form a New York State Association of Museums to seek these ends.

State Science Service

Within the next year we may look for a change in the kind of work that the Science Service will undertake in its new laboratories, equipped with the latest devices. Immediately, there will be a shift from 19th century methods of observation to quantitative research and the more accurate identification of materials with new instrumentation. Look also for increased visitation and use by scientists from nearby universities who have already applied to use the new facilities. In the future the museums will do more of the nation's research as universities fill up, teaching loads increase and professors have less time for work in their own laboratories. They will want permission to work in Museum laboratories. We do have some available bench space.

The work of the scientific surveys is detailed in the reports that follow. In 1956 we stimulated work on the Iroquoian languages of New York, and Dr. Wallace L. Chafe, who was then a graduate student at Yale University, undertook a study of the Seneca language. He has since gone on to join the staff of the Bureau of American Ethnology, Smithsonian Institution, and has completed the work in the present year. To extend supervision and advisory services over a much wider area of the State, the State archeologist has been joined by a junior scientist to

work on highway salvage archeology. He will also work cooperatively with the Department of Public Works and the Federal Bureau of Roads.

Biological research moved ahead on three fronts. After two and a half years of intensive study and trial, the State botanist has discovered a way of tagging ragweed pollen so that he can count it by the introduction of radioisotopes into the sap stream. To do this, he has designed and constructed new pollen samplers which are perhaps the best in the world. In entomology, research is continuing on the white pine weevil which is the primary enemy of an important native tree. A report of these investigations has been completed for publication. In the Adirondacks punkies continue to be a nuisance insect, and attempts to control them in the past have failed for want of knowledge of their biology. With a grant of \$7,000 from an anonymous donor, our entomologists have now worked out the life cycle of these insects and have some ideas about control. The State zoologist has completed editing the first volume of the *Bird Handbook*, a manuscript of over 1,000 pages for publication by the American Ornithologists' Union. A bulletin on the small mammals of Otsego and Schoharie Counties summarizes our participation in an interdepartmental project to investigate the disease rabies.

The major effort of the Geological Survey during 1959-60 was directed toward the compilation of its new State Geological Map. This project is now in the compiling stage which has entailed a great deal of final fieldwork and use of the literature. Our oil and gas geologists in Albany and in the Wellsville office made two significant contributions to the industry by publishing two reports: *Selected Deep Wells and Areas of Gas Production in Eastern and Central New York* and *Correlation of the Silurian Rocks of New York State*. A third interesting development has been the participation of the State geologist in the work of the State Office of Atomic Development.

Cooperation

The Museum was host to the American Folklore Society in August, an event which gave the community pleasure and was the occasion of a special exhibit in the Museum for which we prepared a special brochure. Albany is a good community in which to hold meetings of small learned societies. With the new seminar rooms in our new laboratories, we are planning to bring meetings of 50 to 100 people in the several sciences which we represent in an effort to give leadership to hitherto uncoordinated efforts.

It is always pleasant to go abroad to cooperate with one's colleagues in other museums. At the invitation of the Royal Ontario Museum, I

appeared on the CBC program "Who Knows?" on August 14, and visited an anthropological field party near Toronto.

Our visitor of the year was our colleague, the director of the Ryksmuseum, Amsterdam, Holland, Dr. T. H. Van Luttervelt, who accompanied an exhibit of Flemish paintings, a feature of the Hudson-Champlain Celebration, to the Albany Institute of History and Art.

Because we believe that research in anthropology should carry over into the improvement of the quality of teaching in the social studies, we met and addressed the State supervisors of citizenship education at their Albany conference. We also cooperated in the preparation of an educational TV program that ran for two successive weeks on WPIX in New York. This effort entailed many hours of tutoring and planning with Harvey Zorbaugh, the teacher and script writer, and with David Reese of the State College of Education, Albany, who made the films. The classes of the air made a visit to the State Museum to view the life groups of Iroquois Indians as they lived in 1600; they were taken on a field trip to the Tonawanda Reservation, seeing Senecas as they were a generation ago; and the camera took city viewers into integrated classes such as Indian children now attend in the Akron Central School; and the city children heard a panel of Indian parents discuss educational issues with their principal. We acknowledge our indebtedness to Edward E. Allen, supervising principal of the Akron Central School, to Chief Everett Parker and to our colleague, Francis E. Almstead.

The Museum education staff made a further effort toward improving the teaching of social studies and natural history by assisting publishers to select pictures of the unique objects in the State collections for illustrating books. An example resulting from this type of collaboration is the special edition for young readers of the *American Indian* by Oliver La Farge (Golden Press, New York, 1960).

Permission was granted to York State Film Strips to include views and individual exhibits of the Museum in a series which aims to prepare classes for the visit to Albany. This medium promises to take the Museum and its collections to classrooms throughout the State and beyond. We helped edit and caption seven filmstrips on the *People of the Longhouse* which introduce the concepts of a culture and a society into the teaching of the Indian in the social studies curriculum.

In such collaborative undertakings with media beyond our means and control, the policy is that production costs, including special photography, are borne by the producer; where original written contributions are required of specialists, they are undertaken out of hours on the writer's option.

Some of us who have had a concern about the place of research museums in the national picture agreed to participate in a symposium on "The Role of the Research Museum in Science," which was held at the 55th Annual Meeting of the American Association of Museums, Boston, May 27. Prior to that, the more important anthropological collections in the eastern United States were visited, curators and directors were interviewed, and the results were compiled in a paper on "The Museum and Anthropological research."¹

There were a few staff changes during the reporting period. Terry W. Offield resigned as scientist (geology) September 9 and the position was filled provisionally January 14 with the appointment of Leo M. Hall. The position of assistant librarian (Mrs. Eileen Coulston, who has been so helpful to the scientific staff on reference work) was reclassified to junior scientist January 28. Robert E. Funk was appointed provisionally June 2 to the newly created position of junior scientist (archeology), and Janet L. Stone received permanent appointment as Museum education supervisor June 16.

Having spent six years in getting our own house in order, we are now preparing to move ahead into a wider area of service, in research by the staff in new laboratories, and in enabling our sister institutions of the State to take a more vigorous role in the education of school children and in continuing education beyond the schools.

WILLIAM N. FENTON

*Assistant Commissioner for
State Museum and Science Service*

¹*Curator*, v. 3, No. 4, 1960, pp. 327-355

Accomplishments of the Surveys

Anthropological Survey

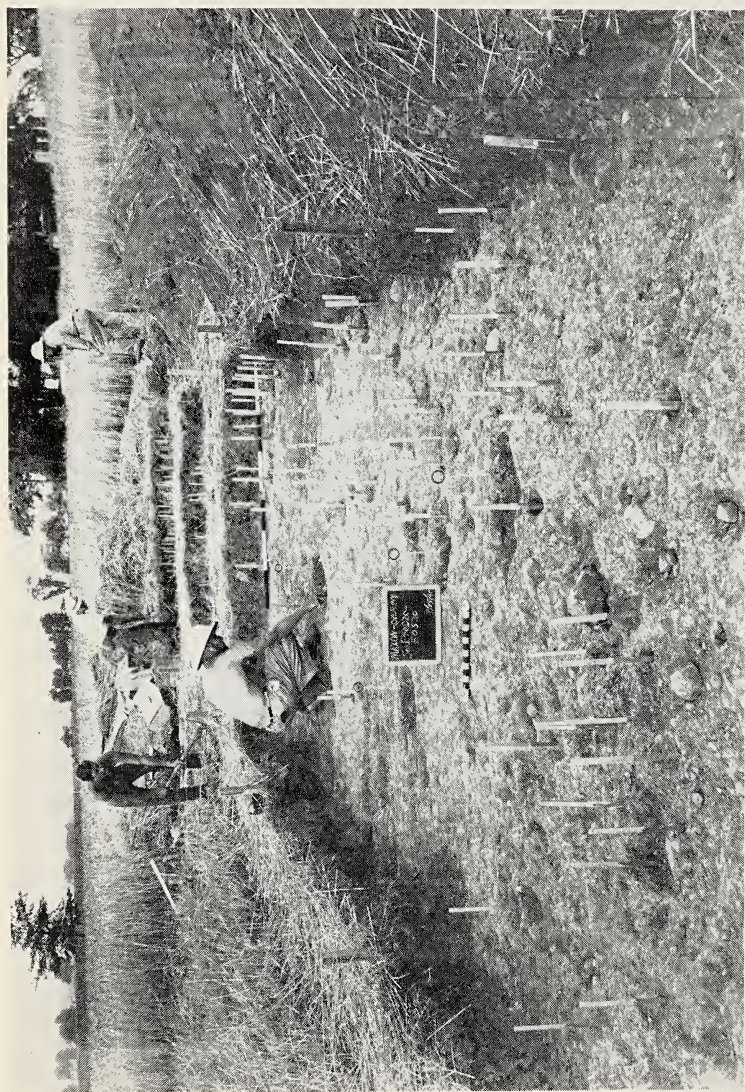
Field Research

THE STATE ARCHEOLOGIST continued his studies of settlement patterns with major excavations centered in the Sackett site at Canandaigua and the Maxon-Derby site near Jordan. Both sites belong to the prehistoric Owasco culture. Small, circular, single-family dwellings were indicated for the former, while on the latter were uncovered the ground plans of large, oval or rectanguloid communal dwellings, suggesting possible longhouse prototypes. Four college student assistants aided in these investigations during July and most of August. In the late summer and early fall reconnaissance projects involving various amounts of excavation ranging in duration from one to ten days were undertaken in the following areas; Piffard, Livingston County; Jefferson County, especially on Grindstone Island and around Perch Lake; near Savannah, Cayuga County; Croton Point and George's Island, Westchester County; Fulton and Washington Counties; and outside the State in Rutland County, Vt. In the spring of 1960 an important Archaic period site near Scotia, Schenectady County, was excavated for a two-week period, with the active cooperation of members of the Van Epps-Hartley Chapter, New York State Archeological Association.

Artifacts of the Dorset and Sarqaq cultures in the eastern Arctic were studied at the Peabody Museums in Cambridge and Andover, and at the American Museum of Natural History in connection with the preparation of a paper for the annual meeting of the Society for American Archaeology.

Laboratory Analysis

Typological studies and formal descriptions of 25 projectile point types were prepared, and a manuscript covering more than 30 such types was completed under the title of *A Typology and Nomenclature of New York State Projectile Points*. It will be published as a Museum bulletin. Field notes were processed, maps were made, and data were analyzed from the excavations on the Sackett and Maxon-Derby sites. In addition, analyses were completed on borrowed site collections from Ketcham Island, Vt., and the Hoosic Valley in New York. Potsherd series were typed for several amateurs and colleagues.



A Science Service archeological field party uncovering house floor outlines (marked by stakes) at prehistoric Owasco culture site on Maxon-Derby farm, Jordan, N. Y.

Office Activities and Administration

The State archeologist wrote nine short articles and abstracts for *American Antiquity*, *Teocentli*, and other journals and papers for annual meetings of the Society for American Archaeology, Eastern States Archeological Federation, and New York State Archeological Association. He interviewed 246 local or out-of-town visitors, including professional colleagues, students and amateur archeologists.

Cooperative Work

The State archeologist served as chairman of local arrangements committee for the annual meeting in Albany of Eastern States Archeological Federation and chaired one afternoon session. He also was chairman of a committee on chapters and membership, New York State Archeological Association, and brought one new chapter into the organization.

Assistance was given to several university research fellows, advanced students and others with archeological problems and dissertations, and numerous nonprofessional archeologists were advised concerning site investigations, analysis and interpretation of their finds, and preparation of reports. Manuscripts were read for several professional colleagues and one university press. Seven petitions for grants-in-aid were evaluated for the National Science Foundation, and data were prepared on New York archeological sites for the National Park Service.

Human remains were identified for the New York State Police Laboratory from five localities and for the curator of the Fort William Henry Museum.

Under a cooperative arrangement with the Smithsonian Institution, Dr. Wallace L. Chafe, linguist of the Bureau of American Ethnology, during July and August completed fieldwork on the Seneca Indian language. This language is one of the most important survivors of the Iroquoian family, which is still spoken at Tonawanda, Cattaraugus and Allegany reservations in western New York. The publication terminates work begun under our aegis in 1956 when Chafe was then a graduate student at Yale. His completed reports are awaited with interest. His publishing plans include a grammar and dictionary of the Seneca language, to be submitted to the Smithsonian Institution press. He will also publish a glossary of the most common terms in Seneca for use by anthropologists, historians and teachers to appear as a bulletin of the State Museum and Science Service.

In cooperation with The University of Buffalo and the Buffalo Museum of Science, and with support partly from the State Science Service,

Dr. Marian White continued field reconnaissance and excavation of early Iroquois sites in Erie County.

A committee consisting of Wallace Chafe, Elizabeth Tooker and Marian White was appointed to plan and conduct the 12th Conference on Iroquois Research, which was held at Red House in October.

Biological Survey

With the continuing aid of research grants and other material assistance from outside sources in each of the Units of the Biological Survey, substantial progress was made on several projects. The first two months of this report period, July and August 1959, represented the active period of the second season of work on the tagging and sampling of ragweed pollen (a project supported by the National Institutes of Health) and the most active period of the first season of research on biology and control of "punkies," a project made possible by a grant known as the Adirondack Entomology Research Fund.

An important accomplishment was the sending to press of the first of five volumes of the *Bird Handbook*, a monumental work which is being compiled and edited by the State zoologist. The project receives its major outside support from the American Ornithologists' Union.

Also, during this period, the data from several years of a cooperative project with the State Conservation Department, the study of white weevil attack as related to soils in New York State plantations, were compiled and submitted for publication as a Museum bulletin.

Field Research by Projects

BOTANY

Identification of aquatic plant fragments using anatomical characters. Eighty-four of the approximately 250 species of aquatic vascular plants in the State have been collected and their stems, rhizomes, roots, leaves and peduncles are in various stages in the process of preparing microscope slides.

Survey of airborne pollen grains and fungus spores. Described in the last previous annual report as "completed, with a final report in press." This report comprises Museum Bulletin No. 378, by E. C. Ogden and D. M. Lewis, entitled "Airborne Pollen and Fungus Spores of New York State," issued in January 1960.

Ragweed pollen content in the air in relation to weather conditions. The paper described in the last previous annual report as "ready for publication" was published in the Journal of Allergy for

July-August 1960 entitled "Field Evaluation of Ragweed Pollen Samplers" by E. C. Ogden and Gilbert S. Raynor. (It is not cited on p. 62 because it was not published until after the period covered by this annual report.)

Pollen spectra of lake and bog sediments. The Crusoe Lake station was revisited, and samples were taken by D. M. Lewis and D. D. Cox from two levels for possible radiocarbon assay. Pollen diagrams for the three sites at this station were completed, and an outline of the findings has been prepared. A final report must await studies now being carried out by the State archeologist. The pollen of 30 species most represented in our reference collections was obtained, and approximately 100 reference slides were prepared from previously collected material.

Tagging and sampling ragweed pollen. This project is in cooperation with Brookhaven National Laboratory and is supported by a U.S. Public Health Service grant. A technique for labeling ragweed pollen in the anthers, so that its release to the air and its buoyancy are not modified, has now been perfected. It involves the use of radioisotopes—radiosulfur or radiophosphorus. Pollen samples taken in the area are processed to produce autoradiographs which readily distinguish tagged and untagged pollen. Several new designs of pollen samplers were constructed and tested in and around a one-acre field of cultivated ragweed and on two nearby meteorology towers. Still further modifications in samplers are being readied for the 1960 hay fever season. A wind tunnel has been constructed for sampler testing under controlled wind-speeds. A complex isokinetic sampler, to be used as a check, is nearly completed.

Checklist of the grasses of New York State. In the course of exploring and collecting for vascular plants in general (see next project), an attempt was made to add to our knowledge of grasses. Eighty specimens were collected, representing 69 numbers, in addition to abundant records on common species and detailed observations on critical complexes, particularly in the genera *Festuca* and *Agrostis*. Three days were spent at the National Herbarium in Washington checking nomenclature and problems in the genus *Panicum*. Work on the checklist is 98 percent completed.

General survey of the vascular flora of New York State. Exploration of the State for vascular plants was continued with special trips made to central New York and Long Island. Records (either sight or those supported by specimens) were made in the following counties: Albany, Cayuga, Columbia, Dutchess, Essex, Fulton, Greene, Herkimer,

Montgomery, Nassau, Oneida, Onondaga, Oswego, Rensselaer, Rockland, Saratoga, Schenectady, Schoharie, Suffolk, Ulster, Warren and Wayne. The work was assisted in the field by Gary Griffin, during the summer of 1959.

ENTOMOLOGY

Biology and control of *Culicoides* (punkies). This was the second season for the project, which is supported by the Adirondack Entomology Research Fund. Studies made in 1959 indicated that *Culicoides obsoletus* was the only species that commonly attacked man in the Adirondacks. The breeding habitat of the species was unknown, and it was not located until the second season. Although conclusive data have not yet been compiled, the following observations were made:

1. Six percent DDT in a fuel oil solvent applied by mist blower to plots of 1 or 2 acres reduced biting populations to a low level for several days in each of five plots.
2. *C. obsoletus* adults were killed by an 8 percent DDT fog, and biting adults were almost entirely eliminated for the period from dusk to dark by fogging a strip 100 feet long.
3. Malathion emulsion (5.7 percent with corn syrup added as bait) applied by mist blower to a two-acre plot did not appreciably reduce the number of biting adults.
4. Solutions painted on window screens to affect punkies attempting to enter houses were tested, and some of them appeared to offer real promise. DDT did not kill fast enough, however, to prevent flies that entered from biting. Malathion gave better results, but further work is necessary to perfect and test different formulations.

Eastern encephalitis vector studies. During the fall of 1959 the virus of eastern *encephalitis* ("EE") was isolated from ducks on Long Island. At about the same time, in New Jersey several human cases occurred, and it was strongly indicated that mosquitoes were the vectors. In a survey conducted by the entomology office of the State Science Service, breeding places of the principal mosquito vector suspect, *Culiseta melanura*, were found in the area where duck farms were numerous. After a joint meeting with State Health Service and other agencies, the Biological Survey agreed to establish a field laboratory to determine the actual vectors of EE on Long Island, to study host relationships and to make other related biological and epidemiological studies. The Long Island Duck Research Laboratory (a unit of the State University Veterinary College) furnished laboratory facilities at their estab-

lishment near Eastport, and the Suffolk County Mosquito Control Commission arranged to pay the salary of a temporary research expert during the summer. Both the duck laboratory and the State Health Department Division of Laboratories and Research arranged to process the vector samples to detect the virus. In addition, the site of the small mammal survey of the Museum and Science Service has been transferred to Suffolk County, partly so that the work can be associated with the encephalitis studies. With these arrangements the eastern encephalitis vector survey began its activities toward the end of the present report period.

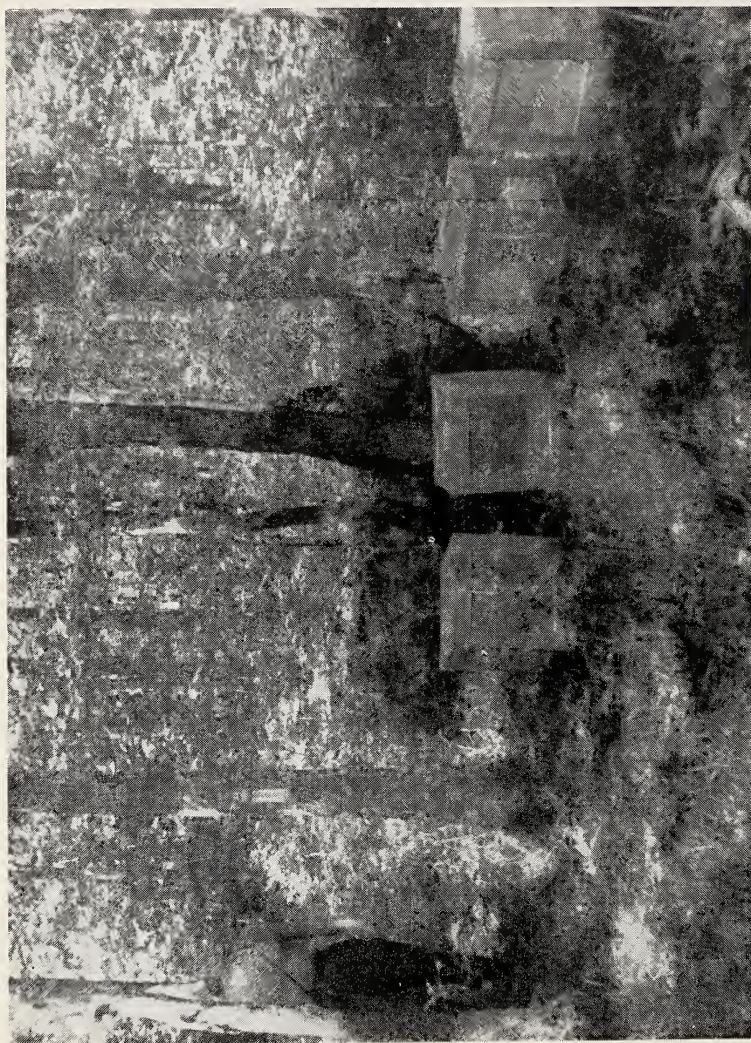
Blackfly studies. One test of a suggested biological control agent (*Bacillus thuringiensis*) was made. A commercially prepared powder (Thuricide) was applied to a stream over a 20-minute period at the rate of about 0.5 ppm. Blackfly larval populations, primarily *Prosimulium hirtipes*, were not affected.

Beech scale studies. Collection of data in the fall of 1960 will complete a 10-year study of beech scale and its association with *Nectria* disease. Field observations in the study plots indicate that the scale-*Nectria* association can be very destructive to beech in the Catskill Mountains. It is hoped that data collected and their analyses may show under what conditions the scale and fungus are most destructive and, by inference, how they may be avoided.

Gypsy moth experimental sprays. Experimental airplane sprays in 1959 and the spring of 1960 indicate that Sevin at 1 pound in 1 gallon per acre (in fuel oil) is as effective at 1½ pound DDT in 1 gallon per acre (in fuel oil).

Gypsy moth biological studies. Biological studies of the gypsy moth carried on by Robert Campbell (temporary research expert) in the Glenville plots near Scotia were concluded, at least temporarily.

White pine weevil spray. In 1959, in tests with a portable mist blower, 6 percent DDT and 4 percent lindane plus 4 percent aroclor in emulsion form gave satisfactory results when directed toward the leaders of white pine. The 1960 tests using 6 percent DDT and 6 percent DDT plus 1 percent aroclor at 3 gallons per acre look very promising. DDT was selected over lindane because of lower cost. Weevil counts after spraying showed a heavy reduction of adult weevils in the spray plots as compared to the check plot. The sprays in 1960 were applied to four rows of trees at one time as compared to one row at a time in the 1959 tests. In both years the spray was aimed at the leaders.



Specially constructed cages set up at a field station for study of diseases and parasites of the gypsy moth

European pine shoot moth. In 1959, using the portable mist blower, tests were made with 6 percent DDT plus 6 percent Arochlor, 6 percent Sevin and 6 percent Arochlor and 2 percent Thiodan plus 2 percent Arochlor. Application was made when 73 percent of the moths had already emerged. One percent Thiodan was ineffective; the DDT gave a 63 percent reduction over the check and the Sevin a 78 percent reduction. Thiodan (2 percent) was ineffective. In 1960, 6 percent DDT and 6 percent Sevin (both with 3 percent orthospray sticker) in water ($\frac{1}{2}$ pound insecticide per gallon) applied at the rate of 4 gallons per acre were applied to infested red pine. Results of tests will be analyzed this fall. Sprays were applied before moth emergence.

Matsucoccus scale. A spot check survey of *matsucoccus* scale along the Hutchinson River Parkway and on Long Island showed that it had not spread easterly on Long Island beyond Commack, but westerly it has spread to the New York City line. In Westchester the scale is more widespread in the southern half of the county but has not made further progress north or east along the Hutchinson River Parkway.

White pine weevil attack in relation to soils. The observations have been compiled and analyzed. A final draft of the proposed bulletin has been prepared.

White pine weevil fertilizer tests. In tests with several fertilizer formulations, begun in the fall of 1958, no relationship between weevil attack and the nutritional factors associated with the fertilizer has been found. Observation in the fertilized plots will continue for another year.

Forest tent caterpillar. In the spring of 1960 an infestation was discovered in the Catskills, and it is planned to use the sequential sampling plan in survey work next winter. (Sequential plan was described in New York State Museum Bulletin No. 366).

Identification and classification of the leaf beetle, family Chrysomelidae. This work is a continuation of projects described in more detail in the annual report for 1957-58. The objectives are a revised taxonomy of the *Chrysomelidae*, a catalog of North American species, keys to the identification of American species and a bibliography.

Manuscripts covering these projects are practically complete. However, considerable work has been done by other entomologists on the South American Chrysomelidae. Rather radical changes in taxonomy and many new genera have been added to the lists of Chrysomelidae, and it is felt that a more thorough study of the literature and an examination

of representatives of the neotropical fauna should be made before any extensive publication is issued on the North American insects.

Biology of the gypsy moth and other forest pests. The work consisted of field observations and identification of insects. Many of the pests were identified in the State Museum; others, parasitic flies and wasps in particular, were sent to specialists for identification.

ZOOLOGY

Small mammal survey, Otsego County: Studies in an area sprayed with Sevin. Small mammal trapping and observations on other wildlife, begun in May 1959, was continued until July 16, 1959; a previous report summarized the work. In this area in July, 115 mammals of all species were taken in live and snap traps (800 trap nights).

Lewis County: Collecting on the Tug Hill Plateau. The move to the new area (headquarters near Lowville) was made early in the report period. Objectives included preparing specimens of Tug Hill small mammals, preserving parasites and accumulating ecological and biological information on the mammals. Bird observations also were made in this little-known area. Trapping was conducted in all months except March; work on the plateau summit was slower, but continued, in mid-winter. Mouse and rat trap nights totaled about 10,000 by June 1960. Measurements, reproductive data etc. were recorded for about 700 mammals. During late winter laboratory analyses were made of many of the stomachs collected up to that time. Two caves were visited in Jefferson County but no bats found. James E. Brower, student, began work as summer assistant on this project on June 1, 1960.

Handbook of North American Birds. Volume I went to press early in 1960. It consisted of 1,091 manuscript pages, 44 text figures, 80 range maps and 6 color plates. Twenty-four authors provided major contributions. Minor contributions and various forms of assistance from about 60 other people also went into the production of this volume. The curator of zoology made the distribution maps.

Office Activities and Administration

In all the offices the personnel took time to answer the usual professional correspondence and correspondence with persons having problems with control of pests. In entomology, termites, stored products pests, mosquitoes and other biting flies appeared to cause the most concern. Requests for advice and for personal appearance of staff members to talk about mosquito control have increased until it is difficult to fit them into the program.

Geological Survey

The immediate effort of the Geological Survey during 1959-60 was directed toward the compilation of its new State Geological Map. This involved correction of the base map mosaic, fieldwork during the summer of 1959, much analysis of the literature and the reduction of data to preliminary maps. In anticipation of the transfer to new offices and laboratories in the wing of the Education Building, a great deal of time was devoted to the analysis and choice of suitable laboratory equipment.

An important increase in gas exploration and development led to equally increased activity for the Wellsville office of the Geological Survey. A well-received contribution to the oil and gas industry was a complete compilation (with maps) entitled *Selected Deep Wells and Areas of Gas Production in Eastern and Central New York* (Bulletin No. 373). "Correlation of the Silurian Rocks of New York State" initiated a newly established map and chart series and was the first of a contemplated sequence of correlation charts of the geologic periods of New York State.

Another activity of unusual interest lay in the application of geology to problems of the atomic age: location of hardened industrial sites, storage of radioactive waste and the correlation of natural radioactive background to congenital malformations.

Field Research

Fieldwork of permanent employees was again concentrated on geological mapping, both for the purposes of the State Geological Map and in greater detail in areas of particular interest. Investigations of mineral resources were also carried on. This work was done both by permanent staff members and by geologists temporarily employed for the summer months.

Geological reconnaissance in the Adirondacks. The field season of 1959 was devoted to geological reconnaissance of the Old Forge and Big Moose 15' quadrangles as well as preliminary work in the West Canada Lakes quadrangle. These areas have been terra incognita, and knowledge of them was essential for the State Geological Map.

Detailed studies of metamorphism in Dutchess County. In connection with a study of progressively metamorphosed shales, samples were systematically collected and selected rocks have been thin sectioned. This will develop into a major research program involving the bulk composition and transfer of trace elements within these rocks of progressive metamorphic grade.



Cooler temperatures do not handicap fieldwork. Here is a New York Geological Survey geologist, well protected from chilling winds, examining the Rensselaer graywacke near East Nassau.

Spot checking for the State map. About three weeks were devoted to fieldwork, mostly in the Taconic region of New York, spot checking the geology of small areas for which knowledge was needed for the State Geological Map.

Fieldwork in the Devonian and Taconic rocks of New York State. Approximately one month was spent working with various geologists on problems of the Upper Devonian and Taconic rocks in central and eastern New York State.

Geologic mapping in Orange County. Geological mapping of the Greenwood Lake and Goshen quadrangles in Orange County was continued. Contributions were made to an understanding of the geology of the Peekskill and Tomkins Cove areas.

Fieldwork of Temporary Personnel

Investigation of limestone by counties. During the 1960 field season work was resumed on the limestone survey. John H. Johnsen of Vassar College began work on a regional report summarizing the geology of limestone in St. Lawrence, Lewis, Jefferson, Herkimer and Oneida Counties.

Taconic geology of eastern New York. Donald Potter of Hamilton College, assisted by Timothy Hall during the summer of 1958 and by John C. Lawrence during the summer of 1959, continued mapping in the Taconic region of Washington County. Well over three quarters of the Hoosick 15' quadrangle have been completed.

Upper Devonian rocks of central and eastern New York. Dr. Robert Sutton of The University of Rochester continued his investigations of the Upper Devonian rocks of central and eastern New York. This has resulted in detailed stratigraphic correlation of great value for the State Geological Map and in deciphering those geological structures that are of interest to the oil and gas industry. During the 1959 field season coordinated studies were carried on not only by Sutton, but by University of Rochester graduate students Elmer Humes, Frederick Manly and Robert Nugent. During the 1960 field season Sutton was assisted by Frank Fletcher and Daniel Twigg.

Glacial geology of western New York. Mapping of Pleistocene surficial deposits continued in western New York under the direction of Ernest H. Muller of Syracuse University. His immediate aim is the completion of the glacial geology west of the Genesee River so that a start can be made on a glacial map of New York State. Work done during

the 1959 field season was in Genesee and Orleans Counties. During 1960 fieldwork was carried on in Cattaraugus and Wyoming Counties.

Knickerbocker Project. A restudy of the geology of the New York City metropolitan area begun in the fall of 1957 has resulted in the completion of the geology of the borough of Manhattan. The data are now being prepared for publication. During the 1960 field season work began on compilation of data in the Bronx. The project is directed jointly by Charles H. Behre, executive officer of the department of geology at Columbia University; J. G. Broughton, State geologist; and Kurt E. Lowe of the College of the City of New York. Dr. Lowe is directly supervising the activities of the geological compilers who have collected a mass of information from State and municipal offices and from private engineering concerns dealing with geology and engineering.

Spot checking for State Geological Map. Approximately 14 days were spent by Lucian B. Platt doing reconnaissance geology in the 7½' Cambridge quadrangle. Geology of the Tug Hill Plateau and, specifically, the Oswego sandstone in that area were studied by William Kruger. Ten days were devoted by Dr. Tesmer to tracing the Cuba sandstone in western New York.

Laboratory Work

Because of the need to complete the State Geological Map, the efforts of permanent staff members have been concentrated toward obtaining data for the map and accompanying correlation charts.

The paleontologists have been engaged in work on the Devonian and Cambrian charts which are nearing the stage when they may be sent to critical readers. The Ordovician chart is only in preliminary form pending the outcome of research not yet completed. The senior scientist continued drafting stratigraphic horizons on 1:250,000 maps in order to facilitate the selection of units to be shown on the final draft. The work was considerably advanced through the use of geologic maps of northern Pennsylvania obtained by loan from the geological survey of that State.

Work continued on the companion volume to Bulletin No. 373, *Selected Deep Wells in Areas of Gas Production in Eastern and Central New York*. The material on western New York, when published, will be of even larger size and greater use. All skeleton logs plus 98 percent of the map work was completed during the last fiscal year. Some field checking is necessary in order to outline the activities of the Medina gasfield. Subsurface mapping of the Onondaga limestone was initiated by the preparation of isopach maps. Work was also carried on in this

line by the senior scientist (paleontology) who worked on the preliminary structure map for the top of the Onondaga and the base of the Tully as well as a preliminary isopachous map of the Hamilton group.

The file of gamma-ray, neutron and electric logs begun a year ago is increased as the records are made available by the oil and gas industry. A project of considerable importance in the oil and gas work is the location of wells on $7\frac{1}{2}'$ quadrangles. Previously these have been shown on $15'$ quadrangles with some loss in accuracy. Transfer of data was carried on by William Turner, a student at R.P.I., and Paul Graziade, a student at Notre Dame. Considerable progress was made on this project. Preparation of the manuscript concerning the bedrock geology of the Richfield Springs and Cooperstown quadrangles is in progress. This is a joint project of the senior scientist (paleontology) and Donald H. Zenger of Cornell University.

The State paleontologist completed a typescript on tentaculitids, hyolithids, cornulitids, coleolids and other miscellaneous shells of uncertain biologic affinities. His manuscript, with illustrations by Mrs. John Winslow, will be published as part of Volume W of the *Treatise on Invertebrate Paleontology*.

Under the direction of Arthur Van Tyne, almost 34,000 feet of well samples were collected. The samples are a valuable source of information on the subsurface rocks in New York State and finds a wide use by individuals and companies. During the last fiscal year temporary personnel was hired to cut these samples and put them in better form for use. The total footage cut was 32,846 feet. Our present excellent position in regard to samples cut and the ease with which visitors can consult this important source of information is felt to justify the small expenditure necessary to complete the job. Other office work entailed compilation of data on well-plugging procedures for legislative committees working on the oil and gas law, preparation of the subsurface structure map of Allegany State Park area for use by the State Attorney General's office in connection with legal proceedings against the State of New York and compilation of a report on characteristics of oil and gas reservoirs of the State for a report on a study by the American Association of Petroleum Geologists.

The State geologist continued to act as consultant to the Office of Atomic Development and also was appointed to a subcommittee of the Atomic Development Commission on site location for nuclear development. This involved location of sites for storage of radioactive waste, nuclear reprocessing plants, high flux test reactors and an atomic port for New York State.

Office Activities, Administration and Special Travel

Broughton and Kreidler served as consultants to the Joint Legislative Committee on Interstate Cooperation concerning proposed legislation on conservation of oil and gas, offshore drilling activities and the underground storage of petroleum products, and the former prepared a report on the mineral resources of the Lake Champlain Basin for the September meeting of the committee at Westport. Acting on staff advice, the State geologist approved a number of oil and gas leases which were negotiated between the State Conservation Department and private industry. The annual contract between the U.S. Bureau of Mines and the Geological Survey concerning collection of mineral production statistics was negotiated and approved.

The annual Geological Newsletter was compiled by all staff members. The entire staff of the Geological Survey carried on extensive correspondence with private individuals and concerns relating to identification of and information on fossils, minerals, rocks, maps, ores, and oil and gas wells.

A new development was the use of X-ray diffraction for mineral identification. A recordkeeping system was initiated and storage facilities were developed for irradiated samples and their respective zones. Eighty-seven mineral samples were run on the X-ray unit resulting in the identification of almost as many minerals that otherwise would have remained unidentified.

The associate scientist (geology) edited several manuscripts and prepared a mineral data sheet for publication in *GeoTimes*. Various staff members did extensive editorial work on manuscripts which had been submitted for publication.

The scientists in charge of the Wellsville Office made 131 well locations, 36 trips to the Northern Gas and Oil Scouts Association meeting, and 85 visits to individuals and companies active in the oil and gas industry in New York State in order to gather data and familiarize them with the activities of the Wellsville office and to exchange information.

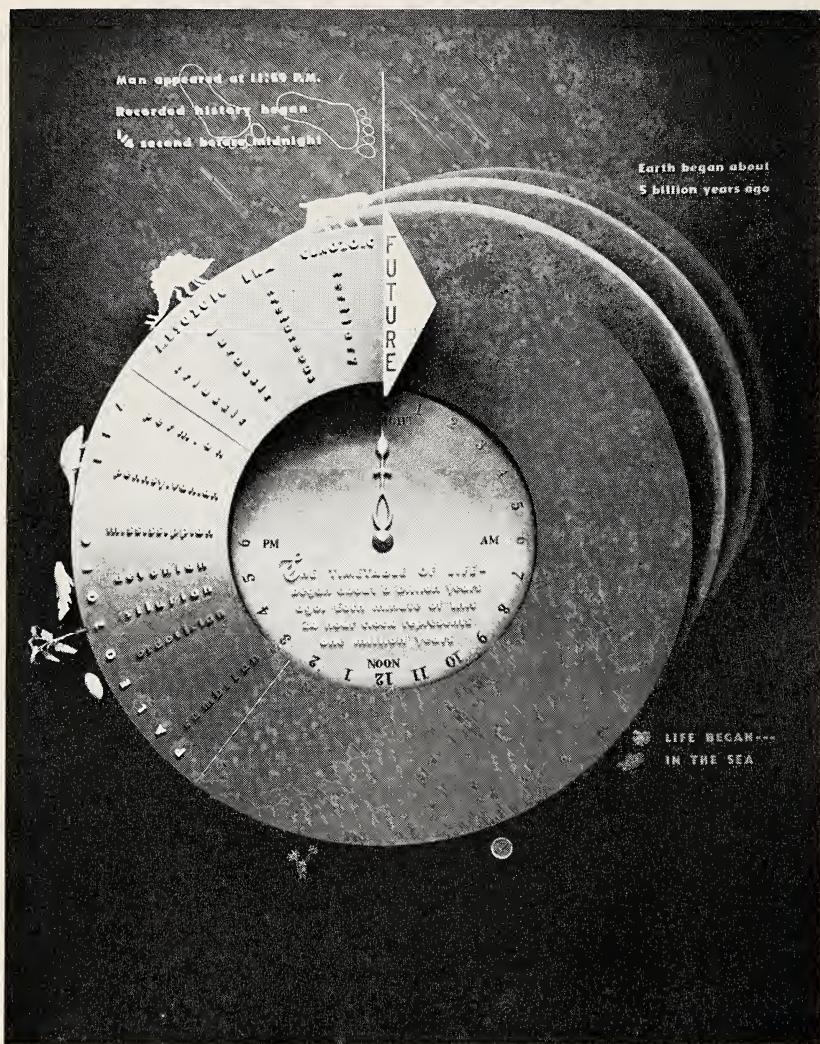
New Projects

The State geologist and associate scientist devoted substantial time during the year to making detailed plans for the new geochemical laboratories. This required visits to manufacturers and other users of similar equipment and the associate scientist attended a school on theory and practice on X-ray spectroscopy sponsored by the North American Phillips Corp. As a result, detailed specifications were set up for the

guidance of the Division of Standards and Purchase in acquiring the new equipment.

The State paleontologist spent about one third of his time planning and conferring with the persons involved in preparing the new exhibits for Paleontology Hall. Information on the results may be found in the Museum section of this report.

Through the cooperation of the State Library, a complete set of the American Society of Testing Material Powder Diffraction data cards was acquired for use with the X-ray equipment. This valuable acquisition will permit making "fingerprint" identifications of all minerals, ores and alloys.



One of a series of new exhibits introducing the visitor to paleontology. Spiraling out of the past we show the parade of life as it appeared on our planet. This billion-year span of life is dramatized in clock form, ticking off a million years each minute.

The Museum

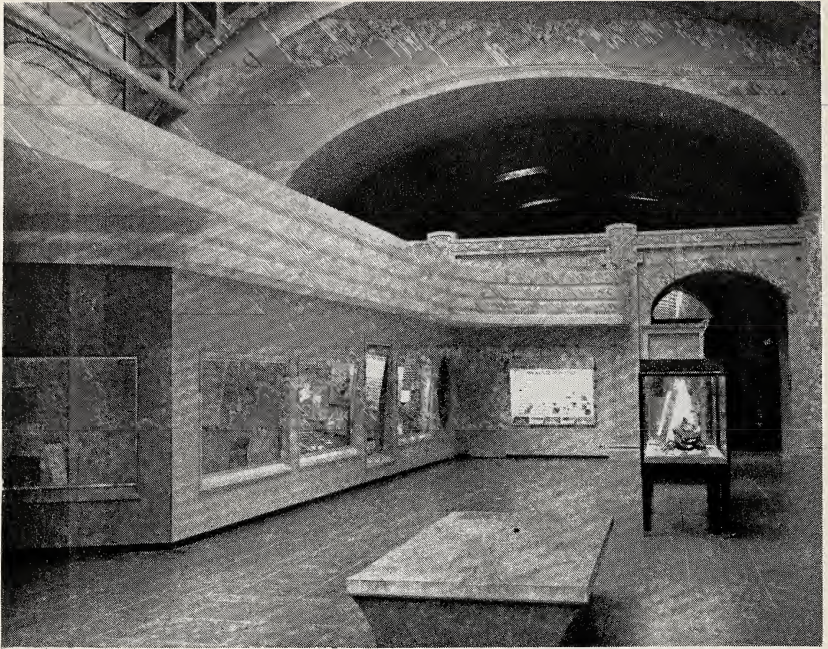
General

ALL SECTIONS OF THE ORGANIZATION made progress during the year in acquiring better facilities and in providing better service to the public. While there may not be unanimity of opinion on the most outstanding areas of improvement, those that stand out in retrospect are the herbarium, which was provided with much better working conditions, and Paleontology Hall, which saw the unveiling of the first quarter of its new, modernized exhibits.

During the spring and early summer of 1959 approximately 52 tons of botanical materials and their storage cases were moved from the fourth to the fifth floor and reestablished in Biology Hall. An area about 40 by 75 feet was segregated by lining up exhibit cases, providing suitable access doors and arranging the storage cabinets for orderly use. Subsequently, worktables, cabinets and racks were built, and the Department installed telephone, gas, sink with plant washing facilities, fluorescent lighting and numerous electrical outlets. Only a fumigation chamber remains to be acquired. While the area is somewhat noisy when Biology Hall is in use by numbers of schoolchildren (who, although not seen by the botanists, are heard very distinctly!), the new herbarium is a vast improvement on the former crowded, poorly lighted and badly ventilated quarters. The betterment is a forecast of things to come for other curatorial fields during the next year. Then the long-awaited transfer of numerous offices and laboratories to the new wing will release considerable space into which other collections will expand.

Another facility which will help a curator to give better service in less time is an X-ray diffraction unit. The machine was assembled from old and recently acquired equipment and put into operating condition through the knowledge and ingenuity of the curator of geology. It greatly simplifies and expedites the identification of minerals, not only in collection material but in specimens which are submitted by prospectors and other persons who seek information.

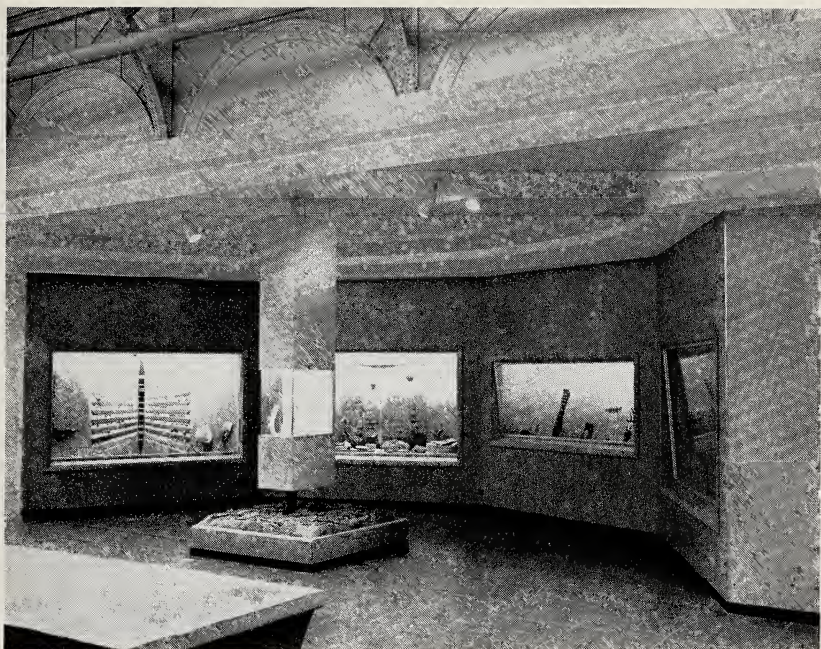
Although limited by funds for temporary services, most of the curators were provided with some assistance for increasing and caring for the collections. More progress was made in sorting and cataloging the chaotic mineral collection than for several years past. A number of much appreciated gifts of scientific material were received from donors. Two of these acquisitions which represented a great deal of time and care



Functional form and color directs and introduces the Museum goer to the story of ancient life. Beneath the fluted canopy that terminates this section of the new structure are the displays designed to prepare the viewer for the fascinating story of paleontology that will unroll as the hall is finished.

in preparation were 1,001 mounted vascular plants from Henry F. Dunbar of Kingston and 3,157 plants of various divisions donated by Roy H. Latham of Orient.

Although three displays were lacking, the portion of Paleontology Hall on which the exhibits staff had concentrated their efforts for almost two years was opened for Convocation. The layout, design, color treatment and techniques show imagination, skill and a blending of scientific knowledge with appreciation for modern educational methods. Although natural light, which is admitted through the glass roof, detracts from the desired effect, the work as a whole is impressive. The holding power of the individual exhibits on visitors' attention is noticeable. In marking the near-completion of this quarter-section of the plans for a modernized Hall of Ancient Life, grateful acknowledgment is made of the interest



Something old and something new: A selection of the oldest and finest fossils from the Museum's renowned collection are displayed in this modern alcove as part of the Hall of Ancient Life which is now under construction. The dioramas and specimens depict life in its earliest beginnings.

and encouragement by Department officials. Purchase of some construction materials, including considerable plate glass, was made possible by the allotment of additional funds when the Museum budget was exhausted.

For the work in Paleontology Hall, the regular services of the designer, two preparators, and the carpenter and helper were supplemented by a design assistant (full time after January 1), an artist (about five man-months), two preparator's helpers (for two man-months) and a carpenter (about six months). As a result, the new display wall with view openings was completed, and seven of the eleven displays in the section were finished. The section was opened to public view in mid-May, together with a newly acquired diorama depicting a Carboniferous coal swamp, a Silurian diorama featuring eurypterids and two temporary exhibits on dinosaurs and the horse. At the close of the year, progress

was being made on one of the four displays still to be constructed for the new permanent section and on three exhibits for the area which will be undertaken next year.

Although progress seemed slow, especially to the staff, the rehabilitation of older exhibits in Biology Hall was virtually completed by the end of the year. The project was given its initial impetus by the clearance of space for the herbarium (which in turn was dispossessed of its original quarters by construction of the wing). Except for the loss of the 40-year-old bison and whistling swan groups (the latter in very poor condition), the exhibits suffered little by the construction. On the contrary, their attractiveness and educational value were definitely increased by rearranging and grouping the subject matter, repair or replacement of old specimens, proper labeling, and use of color and light. Wallpaper of appropriate design or other material (such as chicken wiring for the breeds of poultry) was utilized for backgrounds, glass shelving was substituted for the former wood shelves, and fluorescent lights were installed in homemade reflectors for case lighting. The latter enabled us to dispense with the old (and inadequate) overhead lights which festooned the ceiling arches. Floor and lower walls were painted by Department personnel. Finally, the casts of marine animals (porpoises, shark, turtle etc.) were rehabilitated, adapted for suspension by thin wire from the ceiling and were arranged in a naturalistic manner over the largest open space in the hall. It only remains to light them with spot lamps.

Four group displays were exhibited during the year in the small hall at the northwest corner of the Museum. The most pretentious of these shows, on folk art of the Shakers and Iroquois, was the result of a joint effort by the State Museum and the Division of Archives and History. It was planned as a special feature for the annual meeting of the American Folklore Society (which was held in the hall), but was kept on view for about three months. By arrangement with the British Museum (Natural History) we were able to display a group of some 40 striking and artistic photographs made by the photographic staff at that institution primarily to illustrate its scientific publications. Through the courtesy of the Smithsonian Institution, we were able to exhibit a group of bird drawings by Tuttle and later, through a rental arrangement, a photographic show entitled "Anatomy of Nature."

While the total attendance of schoolchildren in organized groups declined slightly from the preceding year, the percentage of those taking advantage of the Museum's docent service for guided tours of the exhibit halls increased from 49 percent in 1958-59 to 60 percent in 1959-60. Beyond doubt, the instruction given these children was improved and

diversified considerably compared with that of the past several years. This enrichment is the result of broad training and experience in nature education which were brought to the program through the appointment of Janet Stone as Museum education supervisor. It is expected that the interest which is being engendered in both teachers and youngsters by lectures, demonstrations, live animals and more interesting museum exhibits will draw a larger attendance and greater demand for service. However, it should be noted that these factors during the past year caused an increase in the average size of the guided groups from 23 children in 1958-59 to 26 in 1959-60. This number, in view of poor acoustics and lack of ventilation in some exhibit halls, is already too large for optimum instruction.

The State Museum continued its efforts to stimulate interest of young people in science by displaying the winning exhibits at Regional Science Fairs and by bringing their creators to Albany for brief visits without personal expense. Those students whose talents were thus recognized in the 1959 Science Fairs were Margery Campbell, then a sophomore at Union Springs Central School, who worked out a salt-crystal exhibit and Nancy Dunning, then a freshman at Ithaca High School, who devised means for making photomicrographs with inexpensive equipment.

Visitation to the exhibit halls was computed, as usual, on the basis of sample counts which were taken on about 23 percent of the open days. Estimated total attendance was 145,000, a decrease of 17 percent from the previous year. A portion of this difference in attendance figures is probably due to better use of the available statistics (resulting from much appreciated advice of the Department's Bureau of Statistical Services). However, it is probable that the actual number of visitors was somewhat less in 1959-60, an abrupt reversal of the steady upward trend of the previous three years. It is possible that increasing congestion of downtown city traffic, with ever-greater pressure on the shrinking parking facilities within easy reach of the Education Building, has discouraged more would-be Museum visitors than in the past. It is also possible that completion of the Berkshire spur of the Thruway, which enables through travelers from the east and southeast to detour around Albany, has played a part in this matter. These, however, are only speculations. This problem and others emphasize the need for a scientific study of our Museum visitors to determine their interests and needs. Definite information is required for better administration and intelligent planning for the future.

Among the numerous visitors who identified themselves to us as having a special interest in the State Museum were the following: Mrs. Oliver

(Isabelle Bishop) Dibble of Woodside, Calif., a great-granddaughter of James Hall; E. H. Bryan, retired director of the Bishop Museum in Honolulu; and O. E. Jennings, retired director of the Carnegie Museum, Pittsburgh.

It is a pleasure to report that comparatively little vandalism occurred in the exhibit halls. The only significant damages resulting from deliberate intent were slashes in the upholstered back of a bench in Biology Hall and egg (?) splatters on an Iroquois mask in a special exhibit on folk arts. The bench upholstery was repaired, and the mask was cleaned without detriment.

Except for notices of the opening of temporary displays borrowed from other institutions and information concerning holiday schedules, little attention was paid to the Museum by local newspapers. A feature article by Rosemary Clark on the institution, its history and exhibits was printed in *The Conservationist*. Several radio "shorts" on the Museum and its primary fields of interest were issued by the State Department of Commerce and were widely used by broadcasting stations in New York State. A 12-minute account of the Gilboa fossil forest exhibit was taped by professor Floyd Carlson, of the State University of New York, College of Forestry at Syracuse University, and broadcast on the Empire State FM School of the Air. An illustrated booklet entitled *The Oldest Forest* was prepared by the Museum education supervisor as supplemental information for distribution after the broadcast.

A major disappointment of the year was the rejection of a petition to the National Science Foundation for funds to satisfy the personal assistance and equipment needs of the curators. The petition was submitted before the middle of the period and, as a result of an "inspection" visit by three foundation representatives, was supplemented with additional information. Unfortunately, the request by the State Museum was unable to compete successfully with an unusually large number of demands for the limited money available. This turndown makes it imperative to secure approval for the purchase from State funds, over the next five years, of some \$26,000 worth of storage cases, steel shelving and related equipment. Also involved in the unsuccessful petition was a request for an equivalent amount to hire a senior curator (mycologist) and four junior curators. The latter would have served as assistants for the curators to undertake the less exacting phases of the latter's duties. Other major needs of the State Museum are funds for more workers and materials to speed up the exhibits modernization program; adequate ventilation and a new roof for the main exhibit halls (fronting on Washington Avenue) to admit air and to exclude rain and light; and a recep-

tion center, equipment and materials to enable the staff to do a better educational job for visiting schoolchildren and teachers. Lunchroom facilities for school groups would also be of great assistance in the Museum education program.

Curatorial Activities

Archeology

During the year 1959-60 the curator of archeology answered the requests of at least 125 visitors to his office. A few of these inquiries were for bone identification by the State Police, Bureau of Criminal Identification; photographs of ethnological specimens to illustrate two books; information on Iroquois clothing for a mural; illustrations of Iroquois dances; assistance in making photographs for a filmstrip; information on Iroquois artifacts for artwork; and a series of projectile points for professional study. Other requests were answered by mail, including a photograph sent to the Fels Institute at Yellow Springs, Ohio.

Cooperation with the State archeologist continued by assisting his project of defining the projectile point types found in New York. Typical projectile points were provided from the study collections and photographs for the plates were keyed by catalog numbers and data of locality and collector. The curator also assisted a researcher, James Zell, who typed all Onondaga County projectile points in the Otis M. Bigelow Collection and Livingston County points in the F. M. Crofoot Collection. Further assistance was rendered in the rechecking, repackaging and returning of projectile points borrowed from others for this study.

Collections made on the Canandaigua site, the Maxon-Derby site and the Piffard site by the State archeologist were accessioned, cleaned, repaired and cataloged.

Active assistance was given to Mrs. Donna Taylor, a graduate student at Columbia University, in her analysis of wampum belts. The belts were removed from exhibit and storage for her inspection, and all catalog information on them was given to her. Those belts that had not been X-rayed, as well as the invitation wampums from the Beauchamp Collection, were taken by the curator to the State Health Laboratories where such X-rays were made.

The "Esopus Treaty" wampum belt was borrowed from Ulster County for study and repair. A buckskin coat, sash and war bonnet belonging to the Constable Hall Association were borrowed for study and fumigation.

In Morgan Hall, artifacts temporarily stored in units as they came from dismantled exhibits were distributed in the range storage according to county and township.

Several new archeological sites were added to the site record files, and 115 slides were bound and added to the collection. Work on the permanent accession records and catalog card files, which had lagged due to insufficient clerical help, was speeded up.

Botany

The entire collection was moved last year from its former positions to new consolidated quarters at the rear of Biology Hall. This has allowed arrangement of all materials in a linear equating of a phylogenetic sequence. It has also permitted the interpolation of both New York State and out-of-State collections in one sequence. The ranges have been equipped with new fluorescent strip lighting. An alcove, equipped with gas, electricity and running water, has been organized for preparation and mounting of specimens. There is now ample space for sorting, a separate alcove for visitors and room for expansion. The curator was assisted for several weeks in the winter by a temporary employee, Mrs. Frances Carr.

The entire mycological and bryological collections were fumigated during the year.

The nomenclature of the out-of-State collections of mosses was equated with that used in the State collections and the former marked with a distinctive color for easy reference. Duplicate specimens of mosses were separated for distribution to other herbariums. A start was made in placing all out-of-State collections of vascular plants in green folders for easy distinction from the State collections.

Three institutions and nine individuals sent materials in exchange or as gifts. (See p. 44) These accessions are classified as follows:

	FUNGI	ALGAE	BRYOPHYTES	VASCULAR	PLANTS	TOTALS
New York State...	1,183	6	1,309		1,832	4,330
Out-of-State	12	0	2		317	331
Total	1,195	6	1,311		2,149	4,661
<i>By Curator</i>						
In-State	417	3	1,434		952	2,806
Total	1,612	9	2,745		3,101	7,467

The most notable accessions were 1,001 mounted specimens of vascular plants from Henry F. Dunbar, collected by him in Ulster County, and 3,157 specimens representing all divisions of botanical subjects donated by Roy H. Latham, Orient, with few exceptions collected by him in Suffolk County.

Activities during the fiscal year resulted in the addition of 22 possible new members to the known fungus flora. Besides this, Anton Slysh, Paul Smith's College of Arts and Sciences, reported eight species of *Peniophora* for the first time from New York. Most of the specimens of bryophytes await determination. A single new record was noted for the vicinity of Oswego and another for the vicinity of Poughkeepsie. Our botanical work, including the transcribing of current reports in the literature, has resulted in the following numbers of additions of species and subspecies to the records of vascular plants for the following counties:

Cattaraugus ...	1	Greene	10	Saratoga	3
Columbia	5	Herkimer	5	Schoharie	9
Cortland	1	Montgomery ...	1	Suffolk	6
Delaware	1	Onondaga	2	Ulster	6
Dutchess	16	Rensselaer	5	Warren	1
Essex	9	Rockland	1	Wayne	2
Fulton	10				

Entomology

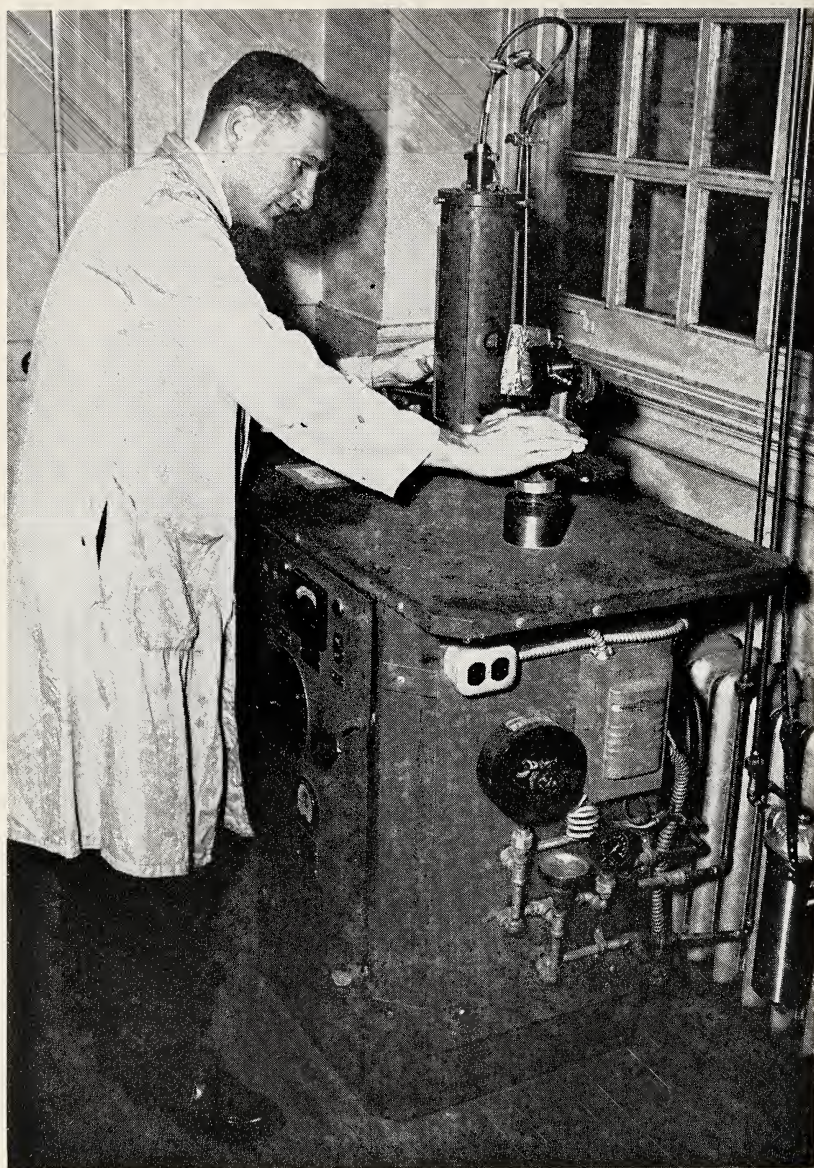
In addition to routine maintenance of the collections, the special project of transferring portions of the collections from cardboard boxes to glass-topped wooden drawers was continued. Moving and rearrangement of most of the duplicate New York State beetles were completed. Similar work was done with a portion of our exotic moths; however, work with this group was curtailed by a lack of storage drawers.

The curator has continued research in the taxonomy of the leaf beetles.

Many insect specimens were collected by the curator and the scientists (entomology) and by William Smith of the Conservation Department. Of these specimens, only a few related to special projects of the entomology office have been mounted and placed in the reference-study collection. Most will be stored dry or in alcohol until an assistant is available to mount and label them.

Approximately 300 requests for information were made to the office of entomology. Most of these inquiries called for the identification of a particular insect and means of controlling it if it were apt to become a pest. Requests were made by telephone, by mail or in person.

Cooperative work with the Forest Pest Bureau, State Conservation Department, included identification of forest insect pests. Considerable effort was made to build up a reference collection of such pests.



*Mounting a powder camera on the Museum's X-ray diffraction unit,
used to identify minerals*

Geology

Acquisition and adaption of new parts and accessories brought into operation for the first time an X-ray diffraction unit. A recordkeeping system was initiated, and storage facilities were developed for irradiated samples and their respective films. Eighty-seven mineral samples were run on the X-ray unit, resulting in the identification of almost as many minerals as otherwise would have remained unidentified. This successfully operating unit, although it is outdated by more modern devices, is a valuable and useful addition to the geological laboratories.

Fourteen hundred and fifty-two specimens from the New York State systematic mineral collection were cataloged. The curator was assisted in this work by three students. As a result, additional data were obtained for the proposed revision of Museum Bulletin No. 70, *A List of New York State Mineral Localities*, which was published in 1903. A conference was held with David Jensen, head of Geological Division, Ward's Natural Science Establishment at Rochester, who will collaborate with the curator in the project.

Seventy-two visitors, many of them schoolchildren requesting samples or information, were assisted during the year. Approximately 280 rock, mineral and ore samples were identified for the public and colleagues. Five hundred sets of New York State rocks and minerals were assembled for sale to students at the information desk. The curator supervised this work, which was accomplished by student help.

On January 7, 1959, the curator assisted junior members of the Capital District Mineral Club in presenting their monthly program. He also accompanied other members during the summer in investigating newly reported mineral localities.

The curator collected 46 mineral specimens from nine localities. Field visits were made to seven major mining operations in the Adirondack region.

Public requests for information totaled 539. The heading indicates the subject about which information was requested; the number which follows is the number of requests received (and answered): rock and mineral specimens and information concerning them, 198; geology of the State, 96; mineralogy (gems and precious stones, locality information etc.), 139; and miscellaneous (caves, books, photos, careers etc.), 106.

Paleontology

Partly because of the continuing program for replacing older exhibits with new displays, a great deal of time was devoted to revising the collection.

Type numbers were changed from the fractional number system to the serial number system on 164 type specimens which had been on exhibit. The contents (306 type specimens and 2,738 nontype specimens) were removed from exhibit cases, and the material was cataloged and stored. Twenty-one new type specimens were added to the type collection, and cards for the same were entered in the catalog. Collections containing approximately 382 specimens were packed for shipment. Ninety-three entries were made in the locality and accession records, and 718 specimens were ticketed with locality numbers. The curator assisted the State paleontologist and senior scientist (paleontology) in extracting material for the new exhibits on brachiopods and coelenterates. As usual, a considerable amount of time was spent in keeping type catalog data up to date. The State paleontologist and senior scientist (paleontology) collected and turned over for accessioning a total of 697 fossil specimens from 28 localities in the State.

Assistance was given to the following visiting scientists who desired to study portions of the collections: Dr. Wilhelm Kegel, Division of Geology, Rio de Janeiro, Brazil (Brazilian fossils); Dr. William A. Oliver, Jr., U.S. Geological Survey (fossil corals); James E. Grierson, Cornell University (fossil plants); William O'Brien, Rensselaer Polytechnic Institute (graptolites); Dr. Michael House, University of Durham, England (fossil cephalopods); William B. N. Berry, University of California, Berkeley (graptolites); Dr. Robert Reidel, Scripps-Howard Oceanographic Laboratory, La Jolla, Calif. (fossil radiolaria); A. L. McAlester, Peabody Museum, Yale University (fossil pelecypods); David Lumsden, University of Buffalo (fossils from Grimsby sandstone); Dr. H. A. Lowenstam, California Institute of Technology (fossils).

Dr. Erik N. Kjellesvig-Waering, Buenos Aires, Argentina, was furnished seven photographs of type eurypterids. Approximately 180 fossil specimens were identified for some 45 visitors, and information on fossils and fossil localities was transmitted to numerous correspondents.

Zoology

The collections were fumigated and given routine care required. In addition, the bird and mammal collections were inventoried, and, where necessary, the specimens were repaired and renumbered and skulls were placed in proper containers.

Bird and mammal specimens were turned over to the Museum by Dr. John Payne, Mrs. Myra Smilow, Mrs. Donald Radke, Mrs. Eleanor Turner, Mrs. B. Shinemann, all of Columbia County; Dan Smiley of

Lake Mohonk; John Belknap of Gouverneur; Marty Hogan of Albany; and several anonymous donors.

Catalog entries now number 19,409, showing an increase of 398 specimens over last year. The majority of these acquisitions are from the small mammal survey. Specimens received from the survey were prepared for storage in cabinets (skulls and skeletons cleaned and numbered) and cataloged. Additional specimens were received, but cleaning and cataloging were not completed in the period reported.

Field trips were made by the curator to the Wilson M. Powell Wildlife Sanctuary at Old Chatham to identify the fauna and faunal niches and to help plan for an educational program using the area in cooperation with biology teachers of nearby schools. Field trips were made, mainly on weekends, with local bird, nature and garden clubs.

Map files on distribution of New York State animals were enlarged. Mapping of bird distribution for the *Handbook of North American Birds* was continued, and earlier maps were revised and otherwise edited.

Letters and phone calls from the public on bird distribution and habits, and on snakes increased over previous years.

Accessions

The collections and, in some instances, exhibits of the State Museum were enriched during 1959-60 by generous donations as follows: (Two items were acquired by purchase.)

Archeology

Specimens from vicinity of Lake Sabago, Maine	Harold M. Ridlon, Naples, Me.
Jasper sample, Vermont	Charles F. Wray, West Rush
Skeleton and charcoal sample	Edward B. Christman, Rensselaer
Specimens from various sites in central New York	Harold Secor, Savannah
Pottery sherds	William Kall, Grindstone Island State Park, Alexandria Bay
Birch bark canoe	Grant Johnson, Ticonderoga
Pottery sherds, St. Lawrence County	Lester Laird, Savannah
Pottery sherds	James Veith, Suffern
"Bust off" from Iverhuron site	Fritz Knechtel, Hanover, Ontario, Can.
Iroquois man's costume (purchased)	Mrs. Adam Spring, Tonawanda Indian Reservation

Botany

<i>Paspalum ciliatifolium</i> from Albany County (10)	Dr. Werner C. Baum, Albany
Vascular plants from Ulster County (1001)	Henry F. Dunbar, Kingston
Plants mostly from New York State (97)	Frederick J. Hermann, Beltsville, Md.
Plants mostly from New York State (3157)	Roy Latham, Orient
<i>Agaricales</i> from the United States (8)	Dr. Josiah L. Lowe, State University of New York College of Forestry at Syracuse University
<i>Phyllosticta aesculi</i> from Albany County (3)	Ralph S. Palmer, New York State Museum
<i>Boletinus glandulosus</i> from Quebec	Dr. René Pomerleau, Sillery, Quebec, Can.
<i>Lactarius chelidonioides</i> from Michigan	Dr. Alexander H. Smith, Ann Arbor, Mich.
<i>Picea glauca</i> from St. Lawrence County	Ralph H. Smith, Delmar
Fungi from New York State (7)	John A. Wilcox, New York State Museum
Plants mostly from New York State (63)	New York Botanical Garden
Vascular plants from St. Lawrence Valley (312)	National Herbarium, Canada

Entomology

Plant galls (71)	Roy Latham, Orient
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Geology

"Boxworks"	Martin Tanymann, Carlisle
Gneissic rock slab showing ptymatic folding (one face polished) from Little Hammond	Prof. R. V. Dietrich, Virginia Polytechnic Institute, Blacksburg, Va.
Actinolite from Yonkers	John Kuhorn, Germantown
Graphite in marble from Wilmington Mountain	Kiah Maynard, Wilmington
Triplite (first occurrence in New York State) from Big Moose	Mrs. William Marleau, Big Moose
Brochantite, linarite and barite roses (4)	Richard N. Quint, Albuquerque, N. Mex.
Uraninite, uranophane, allanite, fergusonite, tourmaline, feldspar, zircon, gypsum, apatite, pyrite and biotite from a pegmatite in the southeastern Adirondacks (51)	Elmer Rowley, Glens Falls

Paleontology

- | | |
|---|--|
| Part of fossil tree trunk from Oneonta sandstone, Oneonta, Otsego County | Richard Cower, Oneonta |
| Thin section slides of our type bryozoa (81) | Dr. Richard S. Boardman, U. S. National Museum |
| Slabs bearing graptolites from Normanskill beds, Grays Corners, Saratoga County | William Krueger, Jr., Rice University, Houston, Tex. |

Donations

Duplicate and other materials which were excess to the needs of the Museum were used to fill requests from schools, cooperating institutions and individuals.

Archeology

- | | |
|------------------------------------|--|
| Projectile points, duplicate (100) | William Whitaker, Greene |
| Projectile points, duplicate (4) | Douglas S. Byers, Peabody Foundation, Andover, Mass. |

Geology

- | | |
|---|---|
| Suite of igneous rocks from the Adirondacks | Department of Geology, George Washington University, Washington, D.C. |
| Collection of New York State rocks and minerals | Harry Osborne, Colorado Springs, Colo., for Annual Boy Scout Jamboree |
| Course-grained graphite from Ticonderoga | U.S. Army Signal Research and Development Laboratory, Fort Monmouth, N.J. |

Paleontology

- | | |
|--|---|
| Fossil specimens, duplicate (6) | C. W. Breedlove, Jr., Marietta, S. C. |
| Rubber casts of trilobites (2) | Dr. Wilhelm Kegel, Divisao de Geologia, Avenida Pasteur 404, Rio de Janeiro, Brazil |
| Fossil specimens, duplicate (16) | Dr. H. A. Lowenstam, California Institute of Technology, Pasadena, Calif. |
| Fossil bryozoa, duplicate (2) | Dr. H. Dighton Thomas, British Museum Natural History, London, England |
| Conularid, <i>Tentaculites gyracanthus</i> , duplicate (3) | Dr. Huntington Williams, Baltimore City Health Department, Baltimore, Md. |

Exchanges

Botany

- | | |
|----------------|---|
| Sphagnum (451) | State University of New York College of Agriculture, Ithaca |
| Sphagnum (161) | New York Botanical Garden, New York |
| Sphagnum (119) | National Herbarium, Smithsonian Institution |
| Sphagnum (52) | Prof. William T. Winne, Union College, Schenectady |

Loans

On request of schools, government, and other institutions and scientists, materials in the collections were loaned as follows:

Archeology

Indian peace pipe	New York Department of State, Albany
Ethnological pieces: (club, spoon, tanned deerskin, baskets, paddle, bowl, braided corn, arrow points)	Whitney's Department Store, Albany
War club and bows (2)	First Church of Albany
Silver peace medals (2)	Smithsonian Institution, Washington, D. C.
Cranium and mandibles (2)	Menands Public School, Menands
Projection slides (11)	Stanford Gibson (NYSAA), Norwich
Skull	Manufacturers Architectural Representative Service, Albany
Pottery sherds (10)	St. Lawrence University, Canton
Type projectile points (14)	St. Lawrence University, Canton
Ethnological items (21)	Schenectady Museum, Schenectady
Projection slide	National Park Service, Philadelphia, Pa.

Botany

Specimen of fungus and specimens of moss (12)	State University of New York College of Forestry at Syracuse University
Critical specimens of fungi (28)	New York Botanical Garden, Bronx Park, New York 58
Type specimens of fungi (4)	National Fungus Collections, Plant Industry Station, Beltsville, Md.
Type specimens of fungi (10)	University of Chicago, Chicago, Ill.
Type specimen of fungus	University of Michigan, Ann Arbor, Mich.
Type specimens of fungi (3)	University of Tennessee, Knoxville, Tenn.
Type specimen of fungus	Tulane University, New Orleans, La.
Type specimen of fungus	Forest Biology Laboratory, Canadian Department of Agriculture, Maple, Ontario, Can.
Critical specimens of fungi (6)	Forest Biology Laboratory, Canadian Department of Agriculture, Sillery, Quebec, Can.
Type specimens of fungi (8)	University of British Columbia, Vancouver, B. C.
Type specimen of fungus	Rijksherbarium, Leiden, Holland

Entomology

Scientific study collection of bees
(*Melissodes*) (56)

Vials of aphids (14)

Dragonflies (12)

Drawer exhibits of insects (3)

Insects (19)

Dr. Wallace E. LaBerge, Iowa State
College, Ames, Iowa

Dr. Mortimer D. Leonard, 2480 16th St.
NW, Washington 9, D. C.

Dr. George W. Byers, University of
Kansas, Lawrence, Kans.

West Sand Lake and Miller Hill
Elementary Schools, West Sand Lake

Vincentian Institute, Albany

Geology

Specimens of seibertite, margarite,
masonite, corundolite

A polished limestone concretion

Collections of New York State rocks
and minerals (73)

Department of Geology, University of
Wisconsin, Madison, Wis.

Constance Walsh, Albany

Schools in New York State

Paleontology

Type specimens of fossil brachiopods
(3)

Fossil specimens (28)

Type specimens of graptolites (3)

Type specimens of graptolites (3)

Fossil specimens (25)

Fossil brachiopod specimens (13)

Fossil specimens (25)

Fossil specimens (25)

Type specimens of fossil crinoids (10)

Fossil specimens (31)

Type specimens of fossil brachiopods
(2)

Type specimens of fossil cephalopods
(26)

Dr. Thomas W. Amsden, Oklahoma
Geological Survey, Norman, Okla.

Archbishop Stepinac High School,
White Plains

Dr. William B. N. Berry, Peabody
Museum, Yale University, New Haven,
Conn.

Dr. William B. N. Berry, University of
California, Berkeley, Calif.

Beverly Hill School, Huntington Station

Dr. G. Arthur Cooper, U. S. National
Museum, Washington, D. C.

Deposit Central School, Deposit

East Greenbush Central Schools, East
Greenbush

Leonard Fernow, Cornell University,
Ithaca

Mrs. W. M. Garretson, 84 Carthage
Rd, Scarsdale

R. E. Grant, U. S. National Museum,
Washington, D. C.

Dr. Michael House (of University of
Durham, England), Cornell University,
Ithaca

Type specimens of fossil ostracods (16)	Dr. Robert V. Kesling, University of Michigan, Ann Arbor, Mich.
Type specimens of eurypterids (3)	Dr. Erik N. Kjellesvig-Waering (of Buenos Aires, Argentina), Chicago Natural History Museum, Chicago, Ill.
Fossil specimens (28)	Manetuck School, West Islip
Type specimens of fossil pelecypods (60)	A. L. McAlester, Peabody Museum, Yale University, New Haven, Conn.
Type specimens of fossil corals (7)	Dr. William A. Oliver, Jr., U. S. Geological Survey, Washington, D. C.
Specimens of nontype fossil corals (44)	
Fossil specimens (25)	Oneida Junior High School, Oneida
Thin section slides of type fossil bryozoa (63)	Dr. T. H. Perry, Indiana University, Bloomington, Ind.
Type specimen of fossil bryozoan	June Phillips-Ross, Peabody Museum, Yale University, New Haven, Conn.
Fossil specimens (27)	Pidgeon Hill Elementary School, Huntington Station
Specimens of fossil brachiopods (15)	John K. Pope, University of Cincinnati, Cincinnati, Ohio
Type specimen of a fossil coral	Dr. Erwin C. Stumm, University of Michigan, Ann Arbor, Mich.
Type specimens of fossil branchiopods (4)	Dr. Paul Tasch, University of Wichita, Wichita, Kans.
Type specimens of trilobites (3)	H. B. Whittington, Museum of Comparative Zoology, Harvard College, Cambridge, Mass.
Fossil specimens (26)	Woodland School, Hazel Crest, Ill.

Zoology

Mammals and birds	Birchwood Elementary School, Colonie
Snakes	University of Florida, Gainesville, Fla.
Birds and mammals	Rensselaer County Junior Museum, Troy
Various animal specimens	Convent of Mercy, Albany
Birds and distribution maps	Cornell University, Ithaca
Birds and mammals	Draper School, Schenectady
Birds	New York State Conservation Department, Albany
Birds	Miller Hill Elementary School, West Sand Lake

Museum Exhibits

Design

With one full-time assistant during the last half of the year, the exhibits designer worked up detailed layouts for approximately 15 major displays for Paleontology Hall. He directed and supervised the carpenters in completing the first quarter of the hall construction, made detailed plans and drawings for the structure and its architectural appearance, and drafted the details for each of the custom-built display cases.

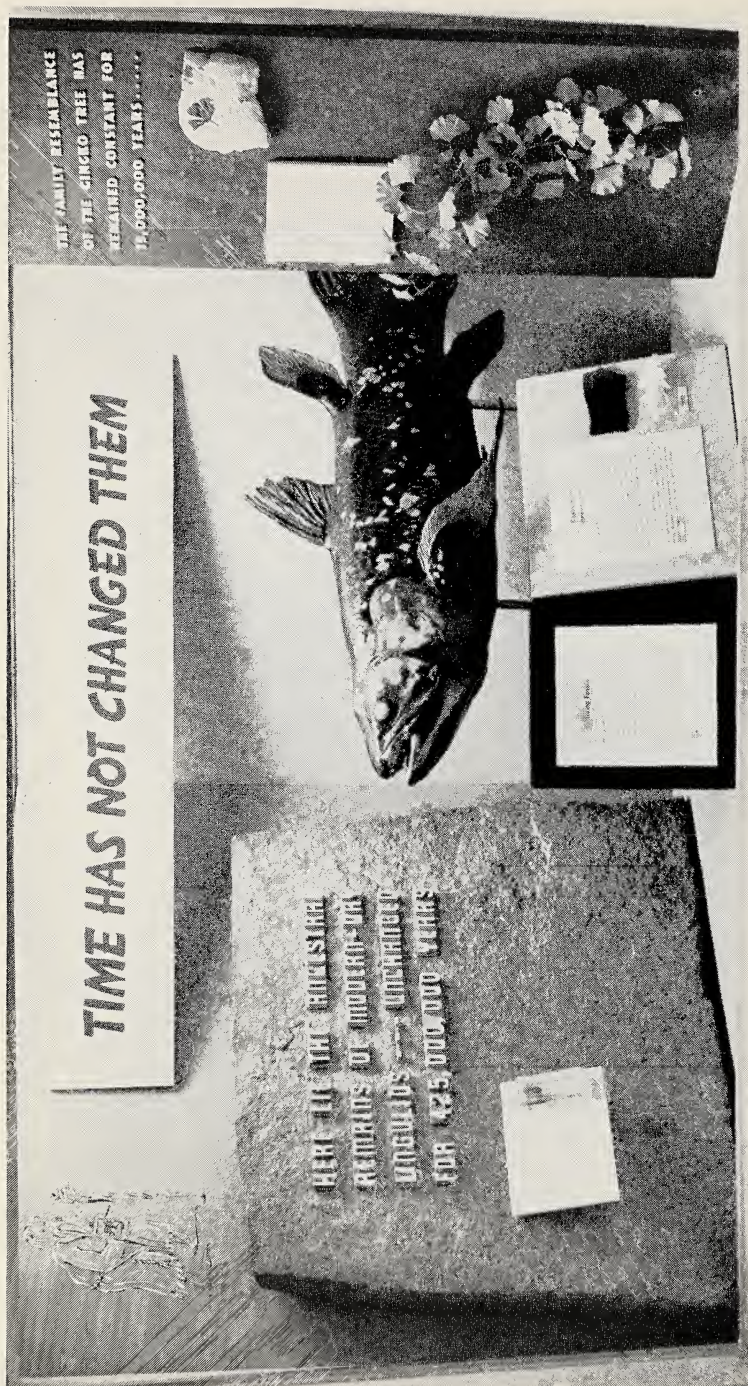
Designs for the following completed or nearly completed displays were made: "How Fossils Are Formed" and "Meet the Paleontologist"; as well as on the geologic timeclock; living fossils; fossil sponges; glass sponges; sponge diorama; Coelenterates; Brachiopods; Cephalopods; Eurypterids; and three dioramas (coal swamp, Eurypterids and armored fish). Advice and directions were given to temporary employees for making exhibits on dinosaurs; the passenger pigeon and bird extinction by Mrs. Edith Froelich; and an exhibit of horse evolution by Louisa Plumb, a student employee.

Among the many other projects undertaken by the designer were: Biology Hall renovation (nearly all the old exhibits and exhibit cases retained for display were redesigned with new interiors), lights and appropriate setting selected for specimens. It involved a general facelifting of the entire hall with a new color scheme and an improved arrangement of traffic flow. The incorporated herbarium included designs for tables, workbenches and color scheme. An arrangement for suspension of five large marine mammals was plotted, and pertaining labels were made and secured nearby. The foyer will receive a new full-scale model of the old Naples Tree for which designs and construction drawings have been made. It will contain a built-in lighting scheme to illuminate the companion fossil slab close behind it. Two new exhibits and cases were designed for a wampum belt display in the Indian groups, and new aluminum railing stock selected for these halls and stairways. Designs were formulated for "free form" tables to be arranged in various combinations in the new conference room. New color schemes and patterns of floor tile were selected for several of the exhibit halls.

Considerable time was spent setting up the "carbon tissue-silk screen" method of labeling. Construction drawings were made for much of the required custom-built equipment.

Preparation

The preparation staff performed the following major items of maintenance: New York State relief map twice cleaned and repaired; mastodon



Nearly all the early forms of life have succumbed to Father Time, leaving only fossil traces. This newly installed exhibit in Paleontology Hall shows the escapees that have remained relatively unchanged for millions of years.

exhibit twice cleaned and renovated; extensive repairs made on Gilboa Forest exhibit; all mounted birds, mammals and fish not on display reconditioned and stored; zoological storage collections reassembled and stored after herbarium was moved and Biology Hall reorganized; light wells in large mammal groups cleaned and lighting improved; Iroquois food plant exhibit cases repaired; marine fish exhibit renovated and reinstalled; five large plaster casts of marine mammals fitted with hangers, restored, recolored and suspended from ceiling of Biology Hall; 400 mounted birds cleaned, renovated and replaced on exhibit; many new bases constructed and over 50 old ones rebuilt; old bird habitat groupings made smaller and reconstructed for exhibit; large number of mounted mammals cleaned, renovated and provided with new bases; new mammals added to exhibit series and unsuitable old ones replaced; a series of mammal tracks carved in plexiglass and mounted for exhibit; old bison group dismantled and specimens stored; new background painting on glass made for old Devonian cephalopod exhibit; two new wampum belt cases refinished; construction techniques and materials for rebuilding the Naples Tree model worked out and production of new leaf replicas begun.

With the exception of work made necessary by moving the herbarium and reorganizing Biology Hall, the efforts of the preparators were concentrated on the renovation of the Hall of Ancient Life and included the following projects: large glass sponge slab reduced in size and restored as the base of a new sponge pillar exhibit for which specimens and housings were prepared; scale model for coal swamp exhibit prepared and its full-scale counterpart, constructed on outside contract, refurbished and installed; 10 models, ranging from one-cell animals to giant reptiles, created and installed in the geologic timeclock exhibit for which a large "spectrum" was colored and installed; skins and skeletons of four weasels prepared to demonstrate methods of animal preservation; fossil leaf prints and shell reproductions made and installation of fossil formation exhibit completed; living fossil exhibit completed and installed; Upper Devonian and Upper Silurian dioramas completed and installed; five enlarged models of cephalopods made and colored; coelenterate exhibit prepared and installed; horse skull prepared for renovated exhibit on horse evolution and scale models of eohippus reproduced to replace stolen one; old dinosaur exhibit renovated and provided with new labels; replicas of fossil fish model made for paleontology section; complete caribou skin and skeleton prepared for research collection.

For the archeology section, the main projects included: two Indian pipes reproduced; work done on a relief map; large clay vessel repro-

duced and colored; broken stone artifacts repaired; drawings of arrowheads made; plaster letters made and colored; illustrated labels made for Iroquois groups; and various items of field equipment repaired. Assistance was provided in installing the Shaker-Indian exhibit, and material was prepared for an archeology meeting.

In February the exhibits designer and the senior technician spoke before the Museum staff on preparation of exhibits for the new Hall of Ancient Life. A similar talk was given when Education Department members previewed the exhibits thus far completed for the new hall.

The Public

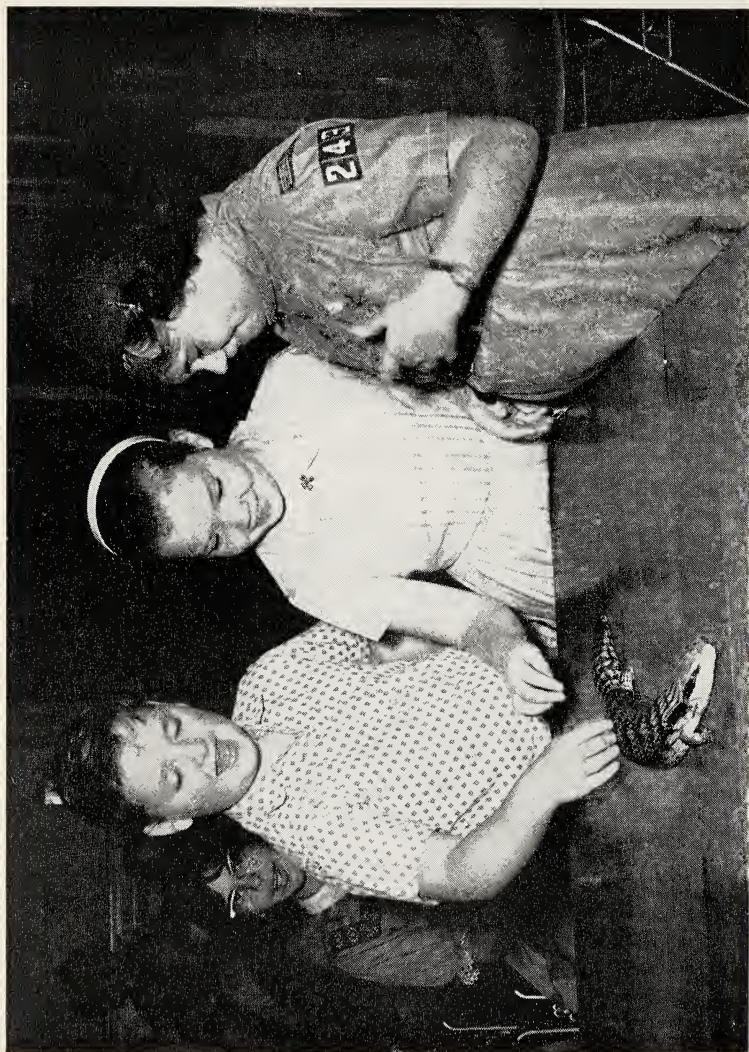
Sample counts of visitors to the exhibit halls were made on 72 of the 325 days during which the Museum was open. Estimated attendance during 252 weekdays, based on the sample taken on 42 counting days, was 114,000. Estimated attendance during 51 Saturdays, based on an eight-day sample, was 20,350. Actual attendance on the 14 Sundays during the summer when the Museum was open was 5,124. Actual attendance on eight holidays was 5,221. Total attendance for the year was approximately 145,000, a drop of 17 percent when compared with the estimate for last year of 175,000.

Highest daily count (1,500) occurred on Saturday, March 12, the day of the St. Patrick's Day parade. Highest count on a normal weekday was 788 (Tuesday, July 7). Lowest count recorded was 188 (Tuesday, December 22). Daily average, including weekdays, Saturdays, Sundays and holidays, was 466.

The Department nurse was called to attend a total of 20 visitors who required some medical assistance. Seventeen of these cases were school-children who fainted or became ill in the Indian groups. This part of the Museum continues to be poorly ventilated despite the use of two fans. There were three minor accidents and one serious accident when, on Saturday, September 19, 1959, an elderly woman fell down the stairs from the Indian groups to Geology Hall and complained of back and hip injuries. No medical assistance was available, but the guards made her comfortable until she was taken to the hospital by ambulance.

The Museum guards have continued to carry out their duties faithfully and efficiently and have performed numerous helpful services. Exhibit cases have been painted and glass washed. All lighted exhibit cases are checked daily and rebulbed as often as necessary. Guards assisted Museum staff members with installation of new exhibits and the renovation of old exhibits. They also aided the carpenters in dismantling and moving

cases and other material from the Museum. It is necessary to cover the cases in Geology Hall and the new construction in Paleontology Hall with large sheets of plastic whenever it rains. Something should be done to alleviate this problem because, should it rain while the Museum is closed and no guards are on duty, extensive water damage could occur. The guards helped with the equipment used by staff members of New York State College of Education in preparing a film to be shown in classrooms of public schools.



Learning animal characteristics from living specimens is a new phase of the instruction provided by the Museum.

Special Services

Museum Education Program

THE MUSEUM EDUCATION OFFICE provided instruction for the teachers, youth leaders, school classes and other groups that visited the Museum during the year. The staff continued to adapt its teaching to the particular needs of these groups by giving subject matter lesson tours to augment classwork and by giving introductory talks. Natural history tours are now enlivened by live animals.

The filling of vacancies on the staff made it possible for the education office to give guided tours to a larger proportion of the total number of groups which visited during the year. The position of Museum education supervisor was filled in October by Janet L. Stone and that of part-time instructor by Mary Jane Stauch. Additional instruction of a more specialized nature was provided at the Museum and in the field by Museum curators and scientists.

Efforts by the staff to conduct guided tours of maximum effectiveness continued to be balked by the poor acoustics of the exhibit halls. Other factors which also reduce the effectiveness of the Museum education program are overcrowding during the spring months, lack of a suitable reception center for groups and lack of lunchroom facilities.

Instruction for Visiting Groups

Brief introductory talks and longer guided tours on Indians, animals, rocks and minerals, fossils, birds and other subjects were given to groups ranging in age from preschool through adult.

Total attendance by groups was 28,936, a slight drop (2.5 percent) from the year before. Of this total, 60 percent (17,406) received guided tours as compared with only 49 percent the year before. This desirable increase was somewhat offset, however, by a rise in the average number of students per tour from 23 last year to 26 this year.

Of those who visited in groups, 84 percent were school students. The remaining 16 percent came as members of Scouts, PTA, church and other organizations. The following tables show school and nonschool distribution by grade (or age level) and by service.

School Groups

GRADES	TOTAL ATTENDANCE	TOURS		INTRODUCTORY TALKS	
		NUMBER	ATTENDANCE	NUMBER	ATTENDANCE
Nursery school	18	1	18	—	—
K, 1-3	3,923	135	2,639	1	25
4-6	9,389	308	7,680	2	77
7-9	8,426	145	4,337	6	417
10-12	1,588	20	590	1	154
Multigraded	644	8	515	—	—
College	403	4	63	—	—
Adult education	53	3	53	—	—
Totals	24,444	624	15,895	10	673

Nonschool Groups

AGE LEVEL	NUMBER OF GROUPS	TOTAL ATTENDANCE	TOURS		INTRODUCTORY TALKS	
			NUMBER	ATTENDANCE	NUMBER	ATTENDANCE
Youth	154	4,420	36	1,072	—	—
Adult	30	743	5	171	15	260
Totals ..	184	5,163	41	1,243	15	260

Instruction was provided by the Museum education staff and by curators and scientists as follows:

STAFF MEMBER	NUMBER OF TOURS	NUMBER OF INTRODUCTORY TALKS
Drumm	293	15
Stauch	130	2
Stone	227	8
Fenton	1	—
Fisher	3	—
Gillette	1	—
Koster	2	—
Reilly	10	—
Ritchie	1	—
Smith	1	—
Totals	672	25

Data on 620 visiting groups show that 67 percent of these groups came from within a 50-mile radius of Albany; 29 percent from a distance of 50 to 150 miles; 3 percent over 150 miles; and 1 percent from out of the State.

Museum Education Extension Program

Several members of the staff traveled outside of the Museum building to conduct educational programs for various groups. Examples of some of the programs presented are outlined below. (See also Appendix C.)

The Museum education supervisor addressed the annual winter conference of the Science Teachers Association of New York State, on "How the State Museum Can Serve High School Classes." She also was a resource panel member for a science forum on "School Use of Wildlife Sanctuaries," sponsored by the Tivoli Lake Nature Sanctuary.

The curator of geology presented a talk on career opportunities in geology to students at Philip Livingston Junior High School, Albany.

The curator of entomology spoke to the combined biology classes of the College of St. Rose on how teachers can use insect collecting as a teaching aid.

The curator of zoology presented special lectures on birds and mammals to the Caduceus Garden Club of Schenectady, the Castleton Garden Club, Altamont Elementary School, Cohoes Elementary School, the New Hampshire Teachers Association, the Conservation Assembly of the Berkshires and the Roundtable of Naturalists and Scientists. The curator acted as judge in the annual eastern New York Science Fair and talked on museum matters to the Science Teachers Association of New York at their annual meeting. Field trips for schoolchildren were led to Wilson M. Powell Sanctuary on six occasions, and scout groups were given lectures and demonstrations about animal life and survival in the wilds.

Related Activities

CONFERENCES AND MEETINGS

The Museum education supervisor toured the following museums to observe their educational program: the American Museum of Natural History, the Brooklyn Children's Museum, the Buffalo Museum of Science, the Rochester Museum of Arts and Sciences, and the Royal Ontario Museum, Toronto. The supervisor and the instructor attended the annual conferences of the American Association of Museums in Boston and the Northeast Museums Conference in Buffalo.

PUBLICATIONS

Two articles were prepared for the *Bulletin to the Schools* to assist teachers in planning a class visit to the State Museum and to encourage students to use the Museum during the summer. *The Oldest Forest*, a booklet for intermediate and high school students was prepared to be distributed in conjunction with an educational television program produced

by Dr. Floyd Carlson of the State University of New York College of Forestry at Syracuse University.

MUSEUM SALES DESK

The volume of sales at the sales desk increased from \$600 for 1958-59 to \$3,258.25 for 1959-60. A number of educational items have been added to the inventory, such as a rock and mineral set (see report of curator of geology), nature games, field guides and additional books for children.

The sales list for these items was:

- 1,148 Pamphlets and books
- 812 Rock, mineral and gem stone sets
- 388 Activity kits
- 52 Nature games
- 319 Cards and letter paper
- 2,697 Dinosaur models
- 284 Arrowheads
- 12 Record albums of bird songs
- 10 Hummingbird feeders

There is a demand on the part of teachers and the general public for a greater number of titles in natural history and physical science as well as for inexpensive educational items for children. A saleswoman-receptionist would enable us to serve the public more effectively.

Museum Library

During the past year the master file of addresses to which Museum publications will be sent for review or to which notification of publications will be sent was completed. This entire list, numbering 321 institutions, journals etc., has been coded for facility in use. The periodical routing lists for the State Library and the Museum library were revised.

The total number of items accessioned during the year was 3,412. This is a slight decrease over the preceding year when 3,580 items were accessioned.

The following honorarium reports were received: *Geology of the Magnetite Deposits and Associated Gneisses near Ausable Forks, N.Y.*, by Lorence G. Collins; *Quantitative Mineralogy as a Guide to Prospecting in Metamorphic Regions*, by Lorence G. Collins and A. F. Hagner; *Progress Report on a Study of the Development of Vocalization in the Eastern Bluebird (Sialia sialis)*, by James M. Hartshorne; *Preliminary Report and Geology Map of the Cornwall, N.Y., Quadrangle*, by K. R.

Kothe; *Stratigraphy and Paleontology of the Salina Group in Central New York*, by Willard P. Leutze; *Geology of the Cooperstown, N.Y., Quadrangle*, by Donald H. Zenger.

Correspondence increased this year. Several letters of inquiry were received from librarians of other State geological surveys and/or departments.

Crowded periodical files were cleaned out, and, if necessary, serials of limited interest were taken to the New York State Library, gifts and exchange section. Numerous duplicates were also transferred to that office. Such transfers totaled 776 items. Problems arising through exchanges were solved with assistance of the gifts and exchange section. Changes in the Museum library exchange file were maintained currently.

Photography

A total of 136 separate requests for services resulted in the following: 567 black and white photographs taken; 1,312 negatives processed from field photographs, and 2,467 prints and enlargements made from the preceding. In addition, 101 projection slides were prepared, and 167 color photographs were taken.

This work included both field and office assignments: several sets of slides to be used in talks at archeological society meetings; color photographs of archeological material to illustrate a book; records of the summer archeological field projects; pollen studies; control of punkies and projects concerned with forest insects; reproduction of charts and maps for *Handbook of North American Birds*; enlargements and reductions of topographic maps for the State Geologic Map; illustrations for a treatise on invertebrate paleontology and photographs of type specimens for use of foreign scientists. For the exhibits preparation staff, photographic records were made showing progress and completion of exhibits, and advice was given on methods of preparing labels.

Science Fair students were photographed with their prize-winning exhibits.

Requests for photographic services by the Department included: Ninetieth Convocation Ceremonies; meeting of the State Boards of Education of the Northeastern States and meeting of State Commissioners of Education; dedication of the annex to Education Building; merit award ceremonies and service awards and retirements.

Publications

NINE MUSEUM BULLETINS (including an annual report) and three miscellaneous items were printed during the year. These publications totaled 958 pages of text and 141 plates, figures, maps, tables and graphs. Two of the miscellaneous items, comprising 64 pages and two figures, were multilithed. The third, a large plate showing the correlation of Silurian rocks in the State and issued as the first number in a new Map and Chart Series, was printed by offset.

The number of items published in 1959-60 was double that issued during the previous year, and the total number of text pages increased almost as much (958 in 1959-60 as compared with 438 in 1958-59). Two manuscripts that were completed before the end of the year were held over due to lack of editorial assistance in the Department's Bureau of Publications to prepare them for the printer.

At the end of the year, in addition to the two items "in press" for publication by the State Museum, four manuscripts had been completed for other institutions; they will probably appear before June 30, 1961. The status of manuscripts in process of writing by staff scientists and curators in the various disciplines was as follows:

	To be ready for printing	
	Before June 30, 1961	After June 30, 1961
Archeology	3	1
Botany	3	
Entomology	5	1
Geology—Paleontology	6	8
Zoology	1	1

Publications

State Museum and Science Service

- 1960 121st Annual Report of the New York State Museum and Science Service, July 1, 1958 - June 30, 1959. N. Y. State Mus. & Sci. Serv. Bull. No. 381. Jan. 1960. 64pp. 8 pl.

Cox, D. D.

- 1959 Some postglacial forests in central and eastern New York State as determined by the method of pollen analysis. N. Y. State Mus. & Sci. Serv. Bull. No. 377. 52pp. 14 fig. 1 map

Drumm, J. A.

- 1959 Planning the State Museum visit. Bull. to the Schools, v. 46, No. 2, pp. 73-77. Oct. 1959

Fisher, D. W.

- 1960 Correlation of the Silurian rocks of New York State. N. Y. State Mus. & Sci. Serv. Map and Chart Series No. 1

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Appendix A

1960 Graduate Student Honoraria Recipients

Archeology

JACOBSEN, JEROME—Columbia University	
Study of Ward's Point area in Tottenville, Staten Island, of aboriginal shell midden and "Burial Ridge".....	\$ 504
TAYLOR, DONNA—Columbia University	
Iroquois wampum study	360

Botany

BRODO, IRWIN M.—Michigan State University	
Study of distribution and ecology of the lichens of Long Island.....	492

Entomology

DI CYAN, ERIKA—Syracuse University	
Study of the ablation of the corpora cardiaca of the cockroach.....	360

Geology

CONNALLY, G. GORDON—Michigan State University	
Reconnaissance map of the glacial drift south of the Valley Heads Moraine	408
DODD, ROBERT T.—Princeton University	
Mapping of the Popolopen Lake quadrangle.....	504
SIMMONS, M. G.—Harvard University	
Complete gravity survey over Adirondack area.....	600
SOUTHARD, JOHN B.—Massachusetts Institute of Technology	
Stratigraphic relations of rocks of Lower Devonian Age in northern part of Paleozoic outlier	300
ZENGER, DONALD H.—Cornell University	
Stratigraphic and paleontologic study of Middle Silurian Lockport formation	480

Zoology

BUCKLEY, PAUL A.—Cornell University	
Study of birds along the coast of Long Island.....	180
CARLSON, BRUCE M.—Cornell University	
Chromatographic study of amino acids in various species of larval lampreys	504

\$4,692

Appendix B

Conferences and Professional Meetings in which the Museum and Science Service Staff participated:

- Administrators of Museums in New York State, organization meeting, New York—Cahalane, Fenton
- American Academy of Allergy, 16th Annual Meeting, Hollywood, Fla.—Ogden

American Association of Museums, annual meeting, Boston, Mass.—Cahalane, Fenton,* Stone, Drumm

American Association of State Geologists, annual meeting, Harrisburg, Pa.—Broughton, Fisher

American Committee for International Wildlife Protection, annual meeting, New York—Cahalane

American Ethnological Society, annual meeting, New York—Fenton

American Folklore Society, Albany—Fenton, Gillette

American Folklore Society, joint meeting, Bloomington, Ind.—Fenton

American Indian Ethnohistoric Conference, New York—Fenton

American Institute of Mining Engineers, annual meeting, New York—Broughton

American Institute of Mining Engineers, regional meeting, Bedford Springs, Pa.—Broughton

American Institute of Mining, Metallurgical and Petroleum Engineers, North Creek—Borst

American Mosquito Control Association and Northeastern Mosquito Control Association, joint annual meeting, Boston, Mass.—Jamnback, Collins

American Ornithologist's Union, annual meeting, Regina, Saskatchewan—Palmer

Bureau of Forest Pest Control, annual meeting, Saratoga—Collins, Connola

Carnegie Museum, Ligonier Valley, Pa.—Ritchie

Conference on Arthropod-Borne Encephalitis in New York, Albany—Collins, Jamnback

Conference of Directors of Systematic Collections (Research Museums), Albany—Cahalane, Collins, Fenton; Cambridge, Mass.—Cahalane, Fenton; Lawrence, Kans.—Fenton

Conference on Gypsy Moth Research Problems, New Haven, Conn.—Campbell, Collins, Connola

Conference on Lake Bottom Sampling for Fossil Pollen and Related Subjects, Syracuse—Collins, Ogden, Lewis

Conference with Canadian Health Department on Arthropod-Borne Animal Diseases in St. Lawrence Valley, Wells Island—Collins

Conference on Vector Hazards of St. Lawrence Seaway, Syracuse—Collins

Conference on Status of Bedrock Mapping, Middletown, Conn.—Isachsen

Conference National Science Foundation, Washington, D.C.—Isachsen

Conference U.S. Geological Survey, Washington, D.C.—Isachsen

David Boyle Lecture, University of Toronto, Toronto—Ritchie

Dedication-Osborn Ornithological Laboratory, Peabody Museum, Yale University—Cahalane, Fenton, Palmer, Reilly

Defenders of Wildlife, annual meeting, Washington, D.C.—Cahalane

Eastern States Archeological Federation, annual meeting, Albany—Gillette, Ritchie

Engineers Society of Western Pennsylvania, Bradford, Pa.—Van Tyne

Entomological Society of America, annual meeting, Detroit, Mich.—Jamnback

Entomological Society of America, Eastern Branch, annual meeting, Baltimore, Md.—Connola, Collins

Federation of New York State Bird Clubs, Buffalo—Reilly

Geological Society of America, Pittsburgh, Pa.—Borst, Broughton, Fisher, Isachsen, Rickard

* Read formal paper.

Interstate Oil Compact Committee Meeting, Philadelphia, Pa.—Kreidler
 Meeting of State and University Scientists, Syracuse University, Syracuse—
 Ritchie
 Mohawk-Caughnawaga Museum, annual meeting, Fonda—Gillette
 New Jersey Archeological Society, Trenton, N. J.—Ritchie
 New York Academy of Sciences on Geochronology, New York—Isachsen
 New York State Archeological Association, Rhinebeck—Gillette, Ritchie
 New York State Archeological Association, Van-Epps Hartley Chapter, Schenec-
 tady—Gillette* ; Albany—Fenton, Gillette, Ritchie*
 New York State Geological Field Conference, Clinton—Borst, Broughton, Fisher,
 Isachsen, Kreidler, Rickard, Van Tyne
 New York State Museum Association for Western New York, Rochester—Fenton
 New York Section, Society of American Foresters, Albany—Connola
 Ninth International Botanical Congress, Montreal, Can.—Ogden, Lewis
 Northeast Museums Conference, Buffalo—Cahalane, Drumm, Gillette, Stone
 Northeastern Bird-Banding Association, South Lincoln, Mass.—Palmer
 Northeastern Forest Pest Council, Boston, Mass.—Connola
 Paleontological Research Institute, semiannual meetings, Ithaca—Rickard
 Society for American Archeology, New Haven, Conn.—Gillette, Ritchie
 Twelfth Conference on Iroquois Research, Red House—Fenton,* Gillette, Ritchie*
 Well Stimulation and Cementing Techniques Seminar, Lewis Run, Pa.—Van Tyne

Appendix C

Cooperative Work (Service) : Talks given by the staff of State Museum and Science Service to various groups:

Adirondack Mountain Club, Albany Chapter—Cahalane
 Albany Club of Sigma Xi—Fisher
 Archeological and Historical Society, Schoharie—Ritchie
 Auringer—Seelye Chapter, New York State Archeological Association—Fenton
 Bethlehem School District Librarians—Fenton
 Blue Mountain Lake Association—Jamnback
 Caduceus Garden Club, Schenectady—Reilly
 Canadian Broadcasting Company, Toronto—Fenton
 Capital District Geologist Club—Isachsen
 Capital District Mineral Club—Borst
 Cardinal McClosky High School—Cahalane
 Castleton Garden Club—Reilly
 Cohoes Elementary School—Reilly
 College of St. Rose, combined biology classes—Wilcox
 Columbia County Extension Service, Claverack—Fisher
 Conservation Assembly of the Berkshires—Reilly
 Dana Natural History Society—Fisher
 Dartmouth College, American literature class—Fenton
 Daughters of the American Revolution, Hudson Chapter—Fenton
 Eastern New York Science Fair, Judge—Reilly
 Harrietstown Town Board—Jamnback
 Isaac Walton League—Fenton

* Read formal paper.

Kiwanis Club, Rensselaer—Fenton
 Newburgh Public School, adult education—Isachsen
 New Hampshire Teachers Association—Reilly
 Philip Livingston Junior High School, career guidance—Borst
 Rotary Club, Niskayuna—Fenton
 Rotary Club, Pawling—Cahalane
 Roundtable of Naturalists and Scientists—Reilly
 Sanitariums of New York City and Vicinity Health Department, New York—
 Jamnback
 Schenectady County Historical Society—Fenton
 Schoharie Public Schools—Rickard
 Schroon Lake Town Board—Jamnback
 Science Teachers' Association of New York State—Reilly, Stone
 Scout Groups—Reilly
 State Conference of Supervisors of Citizenship Education—Fenton
 Tupper Lake Fish and Game Club—Jamnback
 Tupper Lake Town Board—Jamnback
 Vassar College Anthropology Club—Fenton
 Wilson M. Powell Sanctuary, field trips for schoolchildren (6)—Reilly
 WPIX—Educational Television—Fenton

Appendix D: Cooperating Agencies

A continuing function of the Museum and Science Service is to co-operate with agencies and organizations concerned with museum and research activities in this and other States, with the governments of United States and Canada, with universities and industry in the discovery, analysis and dissemination of scientific information. These contacts are frequently of reciprocal services, and they arise often out of the personal contacts of the staff and, if so listed, would measure individual participation, but they are here tabulated for the organization.

Albany Medical Center Hospital
 American Civil Liberties Union, Indian Civil Rights Committee
 American Indian Museum
 Buffalo Museum of Science
 Forest Biology Laboratory, Canadian Department of Agriculture
 Forest Disease Survey, Forest Biology Laboratory, Canadian Department of
 Agriculture
 Harvard University: Gray Herbarium, Museum of Comparative Zoology, Peabody
 Museum
 Memorial Hospital, Albany
 National Art Museum of Sport
 National Fungus Collections, Plant Industry Station, Beltsville, Md.
 National Science Foundation
 New York Botanical Garden
 New York State Department of Agriculture and Markets
 New York State Department of Commerce
 New York State Department of Conservation

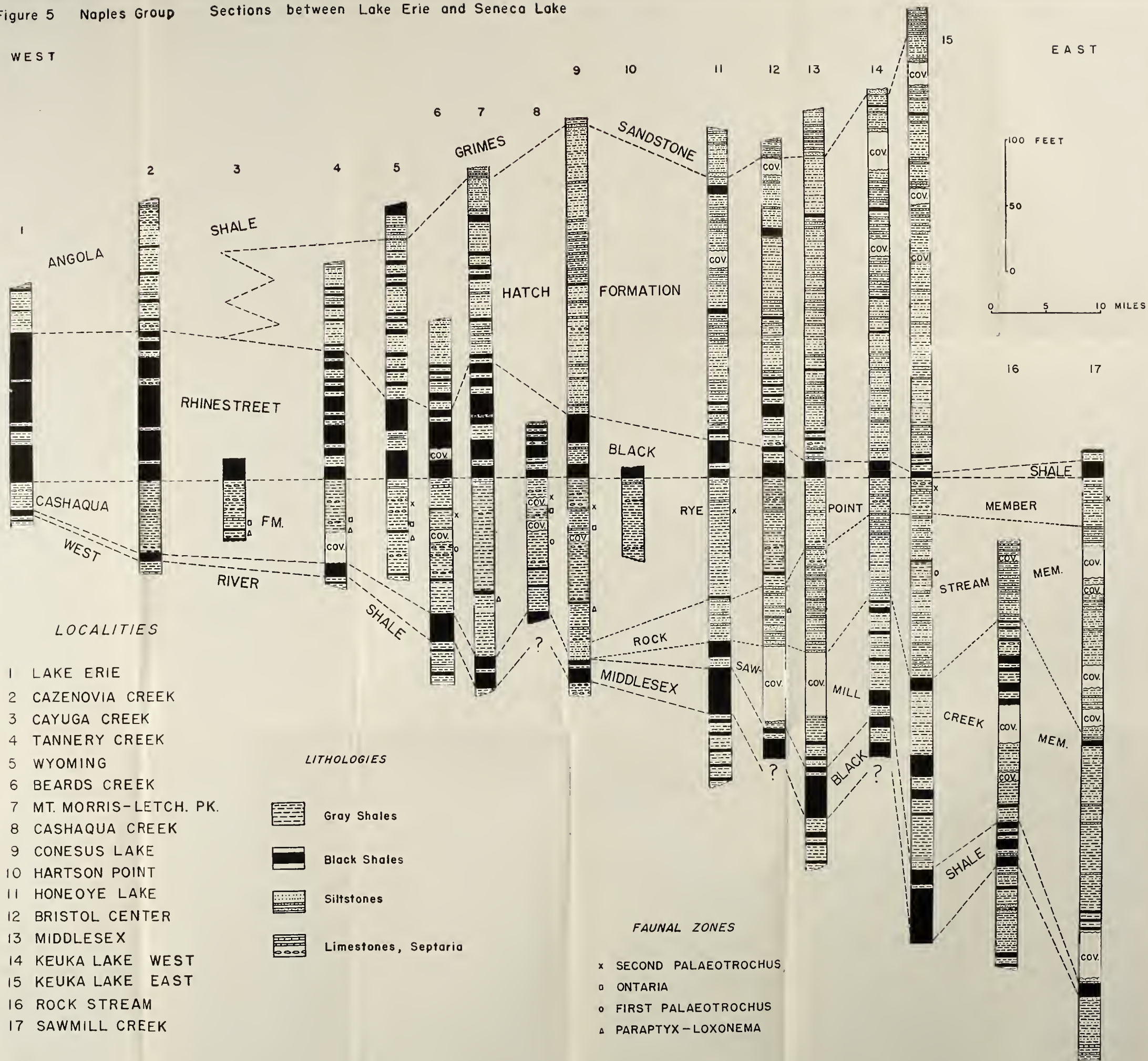
New York State Department of Public Works
 New York State Police, Bureau of Criminal Investigation
 New York State Supreme Court
 New York State Teachers Association, Annual Winter Conference
 State University of New York, College of Agriculture at Cornell University
 State University of New York, College of Forestry at Syracuse University
 State University of New York, Harpur College at Endicott
 Paleontological Research Institution
 Rensselaer Polytechnic Institute
 Rijksherbarium, Leiden, Holland
 Schenectady Museum
 Science Teachers Association of New York State, Inc.
 St. Peter's Hospital, Albany
 Smithsonian Institution, Washington—Bureau of American Ethnology, U.S.
 National Museum
 Syracuse University
 Tulane University
 University of British Columbia
 University of Chicago
 University of Michigan
 University of Tennessee
 Wellsville Daily Reporter
 Yale University and Peabody Museum

Appendix E: Professional Affiliations

Adirondack Mountain Club, Albany Chapter, vice chairman—Cahalane (reelected)
 Albany Club of the Society of the Sigma XI, secretary—Fisher
 American Committee for International Wildlife Protections, vice chairman—
 Cahalane (reelected)
 American Folklore Society, president—Fenton (reelected)
 American Mosquito Control Association, editor—Collins
 American Ornithologist's Union, editor of *Handbook of North American Birds*—
 Palmer
 Defenders of Wildlife, vice president—Cahalane
 Entomological Society of America, Eastern Branch, program chairman—Collins
 Entomological Society of America, member of Culicoides Panel—Jamnback
 Federation of New York State Bird Clubs, Publications Committee—Reilly
 Industrial Minerals Division of AIME, chairman—Broughton
 National Parks Association, president—Cahalane
 New York State Archeological Association, treasurer—Gillette
 New York State Archeological Association, Van-Epps Hartley Chapter, trustee—
 Gillette
 Northeastern Forest Pest Council—Collins, Connola
 Northeastern Forest Tree Improvement Committee, member for New York State—
 Collins
 Northeastern Mosquito Control Association, president—Jamnback
 Society of American Foresters, New York Section, member of Committee on
 Forest Insects and Diseases—Connola
 Society of Mining Engineers, AIME, director—Broughton

11 SAMWILL CRT
9 BOOI
VF

Figure 5 Naples Group Sections between Lake Erie and Seneca Lake



LAKE ERIE

CAZENOVIA
CREEK

TANNERY
CREEK

WYOMING

MT. MORRIS
LETCHEWORTH PK. LAKE

HONEOYE
LAKE

MIDDLESEX

KEUKA
LAKE

SENECA
LAKE

GARDEAU FM.

GRIMES SS.

ANGOLA
SHALE

HATCH

FORMATION

RHINESTREET BLACK SHALE

CASHAQUA FM.

GENESEE

RYE POINT MEM.

ROCK STREAM
MEMBER

MIDDLESEX
GROUP

SAWMILL CREEK MEM.

BLACK
SH.

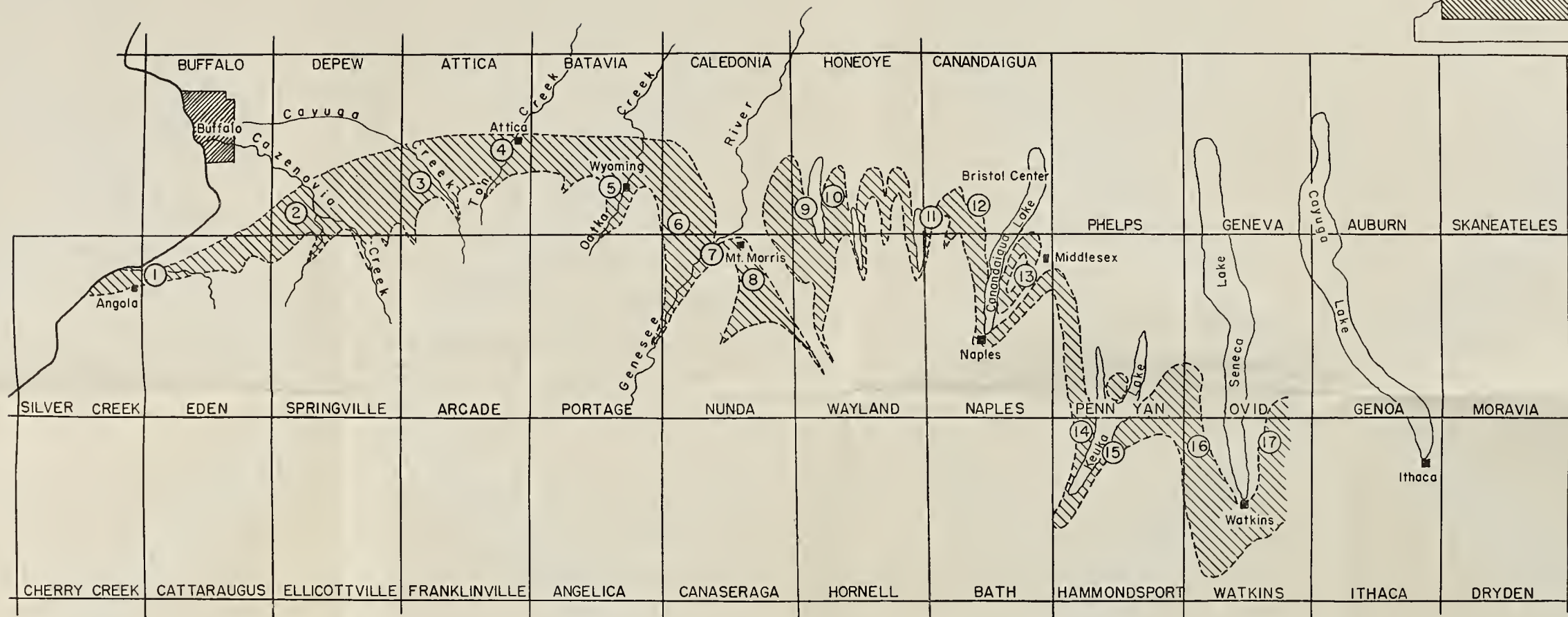
Figure 2

FACIES RELATIONSHIP OF FORMATIONS
IN THE NAPLES GROUP

100 FT
50
0

0 10 20 MI.

INDEX MAP TO
NEW YORK STATE



KEY TO SECTIONS

- | | |
|------------------------------|-----------------------|
| 1. Lake Erie (composite) | 10. Hartson Point |
| 2. Cazenovia Creek | 11. Honeoye Lake |
| 3. Cayuga Creek | 12. Bristol Center |
| 4. Tannery Creek | 13. Middlesex |
| 5. Wyoming | 14. Keuka Lake (west) |
| 6. Beards Creek | 15. Keuka Lake (east) |
| 7. Mt. Morris-Letchworth Pk. | 16. Rock Stream |
| 8. Cashaqua Creek | 17. Sawmill Creek |
| 9. Conesus Lake | |

ONLY 15' QUADRANGLES SHOWN

Figure 1

DISTRIBUTION OF NAPLES GROUP AND
LOCATION OF DESCRIBED SECTIONS

0 10 20 Miles

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